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MUSICAL INSTRUMENTS

IN THE

GREAT INDUSTRIAL EXHIBITION OF 1851.

BY

WILLIAM POLE, F.R.A.S.,

ORGANIST OF ST. MARK'S, GROSVENOR SQUARE.

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Music, although possessing many features in common with the sister arts, has this remarkable peculiarity, that it is in great part dependent on a branch of manufacture, requiring in a high degree the exercise of technical knowledge and mechanical skill. It is due to this circumstance alone, that while poetry, painting, and sculpture attained high excellence at an early period, music is still progressing. The contemporaneous improvement of musical art and of musical instruments has never, we think, been sufficiently noticed; but when we consider that musical instruments are the medium through which the composer makes known his ideas, we find at once a reason for the gradual development of this most enchanting art, as well as a stimulus for increasing the capabilities of the means on which it mainly depends for its expression.

To trace the manner in which the progress of music, and the growth of mechanical ingenuity, have gone on, hand in hand, would be indeed a pleasing and instructive task; but it is out of our province to undertake it here. Our business is with musical instruments, and with the Exhibition of 1851. Let us, therefore—having thus briefly alluded to the intimate connection of this branch of manufacture with the art itself—proceed to examine what is its state of advancement in the present day, noticing what progress has already been made, and what glimpses the World's Fair gives us of improvement to come.

THE PIANO-FORTE

is by far the most valuable musical instrument we possess. It is indeed inferior in particular points to many others, but has on the whole important advantages over all. For example, it is not equal to the organ in power, grandeur, or

variety of tone; but while this colossal instrument is calculated only for a permanent fixture in the church or the chorus hall, and requires, moreover, skill of no common order to play, the piano-forte is portable, is admirably adapted for the requirements of private life, and is, perhaps, more easily mastered, to a certain extent, than any other instrument known. Again, although the piano-forte lacks the exquisite delicacy of intonation and amazing power of expression of the violin tribe, and has but a limited capability of producing sustained tones, yet it possesses the advantage of being a miniature orchestra in itself, capable of executing music in every variety of style, and even of representing, with tolerable precision, all the effects producible by the complicated and expensive machinery of a full band.

It will be our object, after giving a slight sketch of the early history of the piano-forte, to describe, as briefly as possible, its construction, in order to shew the peculiarities of the manufacture, as carried on in the present day; and we shall then proceed to enumerate the examples contained in the Exhibition, offering such remarks upon them as may naturally suggest themselves. It will be interesting to notice, as we proceed, the gradual improvement of the various parts of the instrument; and, in so doing, we may have occasion to allude to some few particular inventions; but it must be borne in mind that in this, as in many similar cases, the gradual advance has rather been due to the combined efforts of many intelligent minds, and to the results of combined experience, than to the isolated improvements of individuals.

Historical notice.

Musical instruments, in which the tones were produced by keys, acting upon stretched strings, are of considerable antiquity, but the piano-forte, properly so called, is an invention of the last century; and it is a curious fact, that many great compositions which now afford useful exercises for this instrument (such as the *Suites* of Handel, and the *Clavecin bien tempéré* of Bach) were written before it was in existence. The instrument that immediately preceded the piano-forte was the *harpsichord,* in which the wire was twitched by a small tongue of crow-quill, attached to an apparatus called a *jack,* moved by the key. The tone thus produced has been not inaptly described as a scratch with a sound at the end of it: the instrument, although great ingenuity was displayed in its manufacture, was very monotonous, and afforded the player no scope except for execution, and that of a most mechanical and

soulless kind. At length, in an auspicious hour for the interests of music, the idea arose that, by causing the key to *strike* the string, instead of pulling it, the tone might be considerably improved, and the general capabilities of the instrument otherwise extended. This contrivance opened an entirely new field to the player, by giving him the power of expression, in addition to that of execution; for, by varying the touch, a greater or less degree of force could be given to the blow on the string,—whereby the effects of *piano* and *forte* might be produced at pleasure. This was the great feature of the new invention, and gave to the improved instrument the name of *piano-forte,* which it has ever since retained. Who was the inventor, does not appear certain. The merit has been ascribed by turns to the Germans, the Italians, and the English; and the date of the invention is equally obscure. The first authentic notice of the instrument we have been able to discover is on the occasion of a visit of John Sebastian Bach to Frederick the Great, King of Prussia, in 1747, three years before this immortal composer's death. The king had been so much pleased with certain "forte-pianos," manufactured by Silberman of Freyburg, that he bought them all up, to the number of fifteen, and placed them in different rooms of the palace. When Bach arrived, the king gave up a concert about to take place, and spent the evening in hearing the great man play on these forte-pianos; and it was on this occasion his Majesty gave Bach the subject of the well-known "Musicalisches Opfer." It is said that the instruments are, or were a short time ago, still existing on the premises; but it is probable they did not subsequently answer the king's expectations, for it is on record that a harpsichord of the best kind was made to his express order eighteen years afterwards, namely, in 1765, by Tschudi, the predecessor of the present firm of Broadwood and Sons, and at that time one of the principal harpsichord makers in London.*

We have evidence that the piano-forte was first known in England about 1767, inasmuch as it was introduced on the stage of Covent Garden Theatre, as "a new instrument," in May of that year.† Its manufacture was soon commenced by the harpsichord makers, whose ingenuity wrought great improvements in its construction, and made manifest the great

* An excellent portrait, by one of Hogarth's pupils, now on the premises in Great Pulteney-street, represents Tschudi in the act of tuning the royal harpsichord. The instrument is still in the palace at Potsdam.

† This evidence is derived from an old play-bill, a copy of which is now in the possession of Messrs. Broadwood. It contains many well-known names, and as it is otherwise a very interesting document, we have been

capabilities of the new principle. A German maker, of the name of Backers, is supposed to have been the first who manufactured the piano-forte to any considerable extent in England, and, to his exertions, it is believed, many important improvements are due. The name-board of a grand piano-forte is still in existence, bearing the inscription "Americus Backers, Factor et Inventor, Jermyn-street, London, 1776." The manufacture was also early taken up by Tschudi, Stodart, Kirkman, Zumpe, and others, and the superiority of the new instrument soon became so apparent, that it gradually superseded the older and more imperfect one—the harpsichord—which, within the short space of ten or fifteen years after the introduction of the piano-forte, entirely ceased to be made. A suitable style of music, and school of players, were not long wanting; Muzio Clementi founded both. He played in public on the grand piano-forte at an early period of its history, and from that date its progress in public favor was rapid. Clementi's successors worthily followed in his steps: finding new wants arise, from time to time, they demanded new improvements to satisfy them; and thus the player and manufacturer vied with each other in the general advance.

General description.

The piano-forte appears usually in three forms, called respectively, the grand, the square, and the upright. In the two former, the strings lie horizontally; in the latter, they are placed vertically.

The grand form, suggested naturally by the varying length of the strings, was an early shape in which the piano-forte was made, being, in fact, the same as that of the harpsichord. It is well adapted for durability, admits of the introduction of

enabled, by the courteous permission of Messrs. Broadwood, to give it entire. It runs as follows:—

By particular desire.—For the Benefit of Miss Brickler.

THEATRE ROYAL IN COVENT GARDEN.

On Saturday next, being the 16th of May, 1767, THE BEGGARS OPERA.—*Captain Macheath*, by Mr. Beard; *Peachum*, by Mr. Shuter; *Lockit*, by Mr. Dunstall; *Filch*, by Mr. Holtom; *Player*, by Mr. Gardner; *Beggar*, by Mr. Bennet; *Mat o'the Mint*, by Mr. Baker; *Mrs. Peachum*, by Mrs. Stephens; *Diana Trapes*, by Mrs. Copin; *Mrs. Slammekin*, by Mrs. Green; *Polly*, by Miss Brickler; with a Hornpipe by Miss D. Twist; and a Country Dance by the Characters in the Opera.

End of Act I., Miss Brickler will sing a favourite Song from Judith, accompanied by Mr. Dibdin, on a new instrument, called PIANO-FORTE.

To which will be added a FARCE, called THE UPHOLSTERER.—*The Barber*, by Mr. Woodward; *Feeble*, by Mr. Murden; *Bellmour*, by Mr. Perry; *Rovewell*, by Mr. Davis; *Watchman*, by Mr. Weller; *Quidnunc*, by Mr. Dunstall; *Pamphlet*, by Mr. Shuter; *Harriet*, by Miss Vincent; *Maid*, by Miss Cokayne; *Termagant*, by Mrs. Green.

Tickets to be had of Mr. Sarjant, at the Stage-door, where places for the Boxes may be taken.

the best kind of mechanism for the action, and is, in short, the most advantageous form in many points of view; it is, therefore, invariably adopted for instruments of the first class. The grand piano-forte has three strings to each note, and is an expensive class of instrument. In order, however, to bring the advantages of this form more within the reach of the public, different modifications have been contrived, to save expense; and, in some instances, with the additional object of occupying less space. Thus, the *bi-chord* and *semi-grand* have but two strings to a note instead of three, and are cheaper in consequence; while the *boudoir* or *cottage* grands have much shorter strings, and take up still less room.

The oblong rectangular piano-forte, commonly called the *square*, was made at an early period; its form was taken from that of the German clavichord, and it was, probably, the first shape in which the piano-forte appeared. It remained, however, an inferior class of instrument until the adaptation to it of the improved action belonging to the grand, which gave rise to the variety called the *grand square;* and, as thus improved, it is perhaps the best substitute for the grand. The form is, however, objectionable on mechanical grounds; it is very difficult to strengthen in the framing, and the oblique position of the action, with regard both to the strings and the key-board, is unfavorable on many accounts to the perfection of the instrument.

The *upright* form of piano-forte has had several phases. At first it was a grand, set on end, and raised on legs about two or three feet above the ground, the strings being struck at the lower end. This form was called the *upright grand;* but its unwieldy height soon led to its disuse, and another form was adopted, called the *cabinet,* in which the frame of the piano-forte was brought down to the ground, the blow being given in front and at the upper end of the strings, through the medium of levers and long vertical rods, communicating from the key to the hammer. The cabinet piano-forte was introduced in the early part of the present century, and, being an elegant piece of furniture, had, down to a late period, a large sale. The principal drawbacks to its use are, first, its height (usually about six feet), which prevents it from being placed anywhere in a room, except against a wall;—a position often inconvenient and disagreeable to the performer, especially for singing;—and, secondly, the length of the action, which interferes considerably with the delicacy and ease of the touch. To remedy these defects, shorter kinds have been made. About 1812, Mr. Robert Wornum introduced an upright

piano-forte, which he called the "Harmonic," but which is now generally designated as the *cottage*, varying from about four to five feet high; and, in 1827, he made a shorter kind still, called the Piccolo, standing only about three feet six inches from the ground. This has served as the model for many others under different names, of about the same size. The small upright piano-fortes, as now made by the best houses, are very good instruments, and are valuable for small rooms, from the little space they occupy, and the facility with which they can be placed in any desired position. The upright form has the peculiar advantage, that the strings are struck *against* their rests, which is generally considered the most favorable direction for the blow, and much simplifies the framing. Many attempts have been made to apply this method of striking to the grand and square forms; but it has not yet come into general use.

The *compass* of the piano-forte was originally five octaves, viz., from the F below the lowest note of the violoncello, to the fifth F above. After some length of time it was extended upwards to C, making 5½ octaves; and piano-fortes, so made, were said to "have the additional keys." As the manufacture and the music improved, another half-octave to F was added in the same direction; and, subsequently, for the better class of instruments, half an octave in the bass, down to C. Another note was finally put on in the treble; and the compass thus arrived at, namely, from CCC (called, on the organ, sixteen-feet C), to G, 6½-octaves* above, is the general compass of the piano-forte at the present day. Some grand pianos are made seven octaves, from A to A, or from G to G; one in the Exhibition, made by Mott, has 7½ octaves, from F to C; and M. Pape, of Paris, has made them eight octaves, from F to F; but it is doubtful whether more than 6½ will be generally used. A considerable advantage, attendant on the increase of the compass of piano-fortes is, that the extra size of the sound-board improves the power and tone of the instrument generally.

In remarking now more minutely on the construction of the instrument, it may be well to bear in mind, that the piano-forte, whatever its shape, consists of four distinct parts, viz., the framing and sound-board,—the stringing,—the keys, and machinery attached for striking the strings (technically

* Makers usually call this compass 6¾ octaves; because, having described the former compass, from C to F, as 6½, they have thought it advisable to add a ¼ octave for the increase of two semi-tones. They should, to be consistent, add two semi-tones more, and then call the compass, from C to A, seven octaves, which would be an excellent *reductio ad absurdum*.

called the action);—and the ornamental case, covering the whole. The latter of these belongs to cabinet manufacture and decorative art. The other three we will take *seriatim*.

Details of the construction.—The framing.

The framing of the piano-forte is a part of the utmost importance, as upon its strength depends entirely the durability of the instrument, and its power of standing in tune. Its principal use is to serve as a strut or stretcher between the two ends of the system of strings, and to keep them apart from each other; and, as the tension of the strings, in a full-sized grand piano-forte, amounts to 11 or 12 tons, or about 25,000 lbs., it may easily be conceived, that the strength of the framing, necessary to resist this force, must be very considerable. Formerly, this framing was constructed of timber only. The strings were looped at one end upon studs, driven into a solid block of wood, which we may call the string-block; while their other ends were wrapped round a series of iron pins, called wrest-pins,* and inserted into another bed of timber, called the wrest-plank. The string-block and the wrest-plank, thus carrying the two ends of the strings, were kept apart by a framing of carpentry, trussed in such a manner as to offer the best conditions for resisting the tension. But, however ingeniously this trussing might be contrived, or however carefully seasoned the timber of which it was composed, it was found insufficient in strength, and subject, in course of time, to give way and become distorted in shape under the immense strain,—causing the piano-forte to lose its permanence of pitch, and to get out of tune. Moreover, the want of reliance on this part of the instrument prevented the introduction of heavier strings, which the makers, urged by the general call for improvement, were desirous of adopting, in order to increase the power, and augment the tone. At length the idea arose of strengthening the framing with the more permanent and stronger material—metal; and a series of improvements were made, which have resulted in the compound wood and metal framing, now used, with slight modifications, by all makers; and which, in its general features, as applied to the grand piano-forte, may be described as follows. The studs, upon which the back ends of the strings are secured, instead of being driven into a wood block, as formerly, are now attached to an iron plate, curved to the

* These are often erroneously called *rest*-pins; but the orthography in the text is the true one; the word *wrest*—"to twist by violence"—referring to the action of drawing up the strings in tuning.

form of the hollow side of the instrument, and called the *string-plate.* From this plate, metallic bars are extended longitudinally above the strings, and parallel with them, to the wrest-plank; their ends being so firmly connected with the string-plate and wrest-plank respectively, as to take upon themselves, in a great measure, the force of tension of the strings. At the same time, the string-plate, being screwed firmly down to the timber-framing below, and the metallic bars also secured thereto at intervals in their length, the whole forms one strong combined trussing, in which both wood and iron contribute to the strength. The bars and string-plate are usually of wrought-iron or steel. The principal parts of the wood framing are composed of the best and soundest oak, thoroughly seasoned and dried, and "glued up" in several thicknesses, by which greater permanence of form is secured.

It will be noticed, on inspecting a grand piano-forte, that the wood-framing under the strings is, of necessity, severed completely across by the opening through which the hammers rise to strike the under side of the wires. To convey the thrust across this chasm, small thin arches of metal are interposed, abutting on one side against the wrest-plank, and on the other against a transverse rail, forming a portion of the main body of the framing, and called the belly-rail. This interruption to the continuity of the under framing, is a great but unavoidable inconvenience, and did it not exist, probably the aid of the metal bars might be dispensed with altogether.

The part that various makers have taken in the introduction of the metallic bracing, has been much discussed; several have contributed to it, and probably much was suggested by the important part which iron, under the auspices of the engineering profession, began to take in the constructive arts at the commencement of the present century. It appears that, as early as 1808, Messrs. Broadwood applied metal tension-bars to the treble;—that in 1820, Mr. Stodart patented the first perfect system of metallic bracing for grand pianos, consisting of the string-plate and bars united;—and that between this date and 1827, other makers applied various modifications of this system, which resulted in the general plan now in use.

Messrs. Broadwood adopt, in some cases, a metal bar running transversely over the wrest-plank, in a direction nearly at right angles to the longitudinal bars, and secured firmly thereto. From this transverse bar, a set of screws descend into the wrest-plank; the object being to hold this part of the frame more firmly in its place, and thereby to insure the stability of the instrument and the steadiness of the tone. When this

bar is added, the number of longitudinal bars may be reduced from four or five to two. The same firm have also lately adopted another system of metallic bracing, the peculiarity of which is that some of the tension bars, instead of running parallel with the strings, are placed diagonally. Specimens of both these varieties are in the Exhibition.

The surface of wood lying extended immediately under the strings is called the *sound-board,* and to it is due, principally, the tone of the instrument. It is analogous to the belly of the violin, and is composed of a thin boarding of the best Swiss pine, perfectly free from knots or imperfections, cut in a particular direction of the grain, and thoroughly seasoned. It is strengthened on the under side with small ribs, and put together with the utmost care. The edges of the sound-board are attached to the framing of the instrument, the whole of the middle part being left perfectly free to vibrate, under the impulse received from the percussion of the strings.

In the square piano-forte, the framing is more difficult to make strong than in the grand, in consequence of the separation of the wrest-plank from the string-plate, by the wide and deep space required for the keys and action. The strengthening is principally effected by bolting the wrest-plank and string-plate firmly down to a strong bed of timber, extending underneath the keys over the whole surface of the instrument, and forming thereto a thick solid bottom. In addition to this, one or two metallic bars are, in the best instruments, stretched across from the string-plate to the wrest-plank, over the strings, and parallel to them.

The framing of the upright piano-forte is the simplest of any, in consequence of its continuity being perfect, that is, unbroken by any openings. The tension is taken by strong struts or bars of timber placed, vertically, at the back of the instrument, to which the wrest-plank and string-plate are firmly secured; so that the force of the tension is resisted by the bars in the direction of their length: they are, in fact, simple columns, and receive their load in nearly the same manner as pillars supporting a building. Iron bracing has sometimes been adapted to the back of the framing of the upright piano-forte, to counteract the pull of the strings on the opposite side.

The stringing

of the piano-forte claims some attention. The strings were originally formed of much thinner wire than is now used, the treble being of steel, and the bass of brass. For the

lowest notes of all, however, strings of simple wire could not be made long enough to give the grave tone, and it was necessary to use lapped wire, *i. e.*, a brass wire, wrapped round with a thinner one of copper; the effect of this being to make the string vibrate slower, and give a more grave sound. Each string was formed of a separate wire, one end of which was twisted into a loop, and passed over the stud in the string-block; the other end being wrapped round the wrest-pin. In the course of the general improvement of the piano-forte, a demand arose for heavier wires, capable of resisting a forcible blow (which formerly caused the thin strings to jar against each other), and giving out a better quality of tone. But here arose the necessity for a new method of fixing the string, it being very difficult to form the loop with sufficient security in the thicker wire. This gave rise to the modern method of stringing, according to which one wire, of double length, is made to form two strings. The two ends are wrapped round two adjoining wrest-pins; the middle of the wire being bent over a stud in the string-plate, at the opposite end of the instrument. The pressure of the wire on the stud is sufficient to keep both strings distinct, as regards their tuning. This method of stringing was invented and patented by Messrs. Collard, in 1827, and is now (the patent having expired) almost universally adopted.

Another improvement, applied to the stringing of grand piano-fortes, is that of the upward bearing of the strings at the striking end. The length of the vibrating part of the string is determined by two bridges, over which each wire passes; one fixed to the sound-board, the other to the wrest-plank, a little in front of the striking point of the string. Now the original plan was, so to arrange the levels of these two bridges, with reference to the ends of the wire, that the string might, when stretched, have a downward pressure upon both. But, since the hammer strikes upwards, it is evident that a heavy blow must exert a tendency, more or less, to lift the string off its bearing; the effect of which is considered detrimental to the tone. On this account the direction of the bearing on the front bridge was reversed, or rather the bridge itself was changed for a plate pierced with a series of holes, through which the strings passed, turning immediately upwards towards the wrest-pins. This gave each string an upward instead of a downward bearing at the front end; the effect of the blow being, under these altered circumstances, to force the string against its rest instead of lifting it from it, as before. The upward bearing is claimed by Messrs. Erard, as having

been described by them in a patent of 1808, and modified and improved in 1821.

The strings used now are entirely of steel wire, brass having been abandoned as too soft and weak for the purpose. The lowest octave in the bass is of lapped wire, but differently constructed to that formerly in use; the main wire is of steel; the wrapping wire is of soft iron for the upper part of the octave, and of copper for the lower. The wrapping too is close, like that of the fourth string of a violin; whereas, formerly, it was open, like the worm of a corkscrew. In the lowest bass notes of grand pianos, where the copper-lapped strings are of considerable diameter, two are considered sufficient, and some makers prefer only one.

The best piano-forte wire is made, expressly for the purpose, by Mr. Webster, of Penn's Mills, near Birmingham.

The action.

This is understood to mean the machinery through which the impulse given by the finger of the performer is transmitted to the string. We have hitherto been considering parts at rest, whose peculiarities consist in their statical qualities; this is the moving part;—the mechanism, whose nature is strictly dynamical. The importance of the action will be evident, when it is considered that its office is to convey, so to speak, the very mind and will of the player; and upon its excellence depends entirely the capability of the instrument to answer to the ever-varying shades of expression which the genius or skill of the performer may prompt him to impress upon the keys.

The earliest actions were very rude: the first was nothing more than a piece of bent brass wire, fixed into the back end of the key, which struck the wire when the front end was thrust down; next, a piece of wood, possibly covered with leather, took the place of the wire; and then came the first real improvement, the addition of the hammer, a separate lever for striking the string, by which a greater extent of motion was obtained, and a more effectual blow given than by the former plan. The hammer was lifted by an upright wire, attached to the back end of the key, and capped with a leather button, which came in contact with the under side of the hammer. The height of this button was so adjusted, that when the key was pressed down as far as it would go, the hammer was a short distance from the string; the effect of this adjustment being that, after the impulse given to the hammer had caused it to strike the blow, it fell back upon

the button, and so left the string free to vibrate. This was called the "single action." It was the simplest form of mechanism, and probably the earliest that obtained for the piano-forte any share of public favor. Square instruments were made with this action as late as the commencement of the present century, and probably many of them are in existence still.

The next improvement was the introduction of the "hopper." The evil of the single action was, that owing to the adjustment already mentioned, the hammer would not reach the string, unless the key were thrust down with sufficient force to give it considerable impetus;—so that it was impossible to play very *piano;* while if, to remedy this evil, the adjustment of the button was altered, to bring the hammer nearer to the string, there was a danger of its not leaving it after the blow—a defect technically called "blocking." The hopper removed this evil. It was a jointed upright piece attached to the back end of the key, and used to lift the hammer, in place of the stiff wire and button of the former mechanism. When the key was pressed down, the hopper, engaging in a notch on the under side of the hammer, lifted it to within a very short distance of the string—so near, in fact, that almost the slightest pressure would cause it to strike; but at this moment, while the key was still pressed down, the jointed part of the hopper coming in contact with a fixed button as it rose, escaped from, or "hopped" out of, the notch, and let the hammer fall clear away from the string. This mechanism, as applied with trifling variation to the square piano-forte, was called the "double action," and is extensively in use for this and the upright form at the present day.

The next improvement was the "check," which we must introduce as before by explaining what was the evil it was intended to cure. The hammer, when liberated from the hopper, fell upon a rail covered with cloth or some other soft bed prepared to receive it: now, when a forcible blow was struck, there was always a danger of the hammer rebounding,—or, in other words, the elasticity of the struck wire would send it down with such force, that it rebounded from its bed, touched the string a second time, and so damped the vibration and injured the tone. The remedy for this was found in fixing to the back end of the key a projection called a *check,* which caught the head of the hammer as it fell, and held it down so firmly that it could not again rise. The check was one of the most important additions ever made to the action; and

no piano-forte, of any pretensions, is considered complete without it.

The whole of these improvements were made at a very early period in the history of the piano-forte. To whom we are indebted for them appears uncertain. Some accounts state that the hopper was patented by Longman and Broderip (the predecessors of Clementi and Co., now Collard's); but there is a tradition that, when the manufacture of the instrument was taken up by Backers, he himself, in conjunction with Mr. Broadwood and Mr. Stodart (both then young men, just embarking in the business), devoted much time privately to the improvement of the mechanism; and that the joint production of the three, when made public (probably about 1770), was the perfect action, known in England as the "grand action," and on the continent as "*die englishe Mechanik,*"—being the combination of hammer, hopper, and check, above described. It has been ever since in use; and, with only one further improvement, forms now the simplest and best action known.

This last improvement is called the "repetition" mechanism; and its object may be thus briefly explained. In the ordinary action, after the hammer has fallen, the key must rise to its position of rest before the hopper will engage again in the notch of the hammer, so as to be ready for another stroke; and hence a note cannot be repeated without not only requiring the finger to be lifted through the entire height of the key's motion, but also demanding a length of time between the repetitions, sufficient to allow of its full rise. The contrivances by which this inconvenience has been overcome are of various kinds, according to the fancy or the ingenuity of the makers; but they all act on the same principle,—namely, by holding up the hammer at a certain height while the key returns; by which means, the hopper is allowed to engage itself under the hammer earlier, and to reproduce the note in less time, and with less labor to the finger, than before. There was at one time a great rage for repetition; and demands were made for it to be carried to an almost absurd extent; but this has now calmed down, and the public are beginning to find that simplicity and general accuracy in the construction are of far greater importance than a *soi-disant* refinement, which, carried to an extreme, has often degenerated into the mere gratification of a whim of the player. Hence, while the repetition movement is still retained, its operation is confined within reasonable bounds, and not allowed to inter-

fere, as it formerly did, with the simplicity and other good qualities of the machinery in general.

The action of the piano-forte has afforded unlimited scope for the ingenuity of the manufacturer; and almost every maker of note has his own pet mechanism. In the best instruments they all consist, however, of the same essential parts, more or less modified in their shape or arrangement, viz., the hammer, the hopper, the check, and the contrivance for repetition. We cannot particularize even all the good actions, saying nothing of the indifferent varieties, but will merely mention a few in most common use.

Messrs. Erard patented a repetition action so early as 1824, which they have continued to use ever since; and a model of which is in the Exhibition. It is exceedingly ingenious, but the arrangement of levers, springs, &c., is very complicated. It consists (excluding the damper apparatus) of no less than seven pieces in motion, and contains seven joints; and, after all, we confess ourselves at a loss to see what results are obtained by it which may not be produced by much simpler means. For these reasons, although it has long been public property, no maker in England has yet ventured to adopt it, except the firm to whom it owes its rise.

Messrs. Broadwood patented, some years ago, a mechanism (the invention of Mr. Southwell), to which they gave the name of the "Victoria repetition;" but they have since laid this aside for a simpler mode of producing the same effect. It differs only from the original simple form of grand action, in having a piece of bent wire attached to the hopper, which, acting on the tail of the hammer as the key descends, keeps it elevated, and so gives the repeating power. This action has but four moving pieces and three centres of motion. A model of this is also at the Exhibition.

Messrs. Collard patented an action in 1827, the invention of Mr. James Stewart, in which the hopper was modified in shape, and in the manner of its escapement. In 1843, they added, also under patent, a contrivance for repetition, consisting of a slight wire-spring, projecting from the hopper, so as to catch the tail of the hammer as it fell. This action is also simple, durable, and effective in its operation.

Several English and foreign makers, among whom may be named Messrs. Stodart, Wornum, Kollman, and Pape, have bestowed much labor in contriving a system of action for striking the strings downwards instead of upwards. Many advantages attend this plan, particularly the avoidance of the

opening in the framing and sound-board, necessary, in ordinary horizontal instruments, for allowing the hammers to rise, and to which we have already alluded; and there is no doubt that, if the downward action could be made to work well, the construction of the grand and square forms of piano-forte would be much simplified, and their cost much reduced. The difficulties and inconveniences attending the reversed form of mechanism, have been, however, hitherto considered, by the majority of makers, as outweighing the advantages gained. Several specimens of down-striking actions are in the Exhibition.

After all, the great criterion of excellence, in a piano-forte action, is the degree of care bestowed on its construction, and the accuracy with which it is finished and adjusted. With these, almost any action, correct in principle, may be made to work satisfactorily; without them, the utmost ingenuity or refinement in the mechanical contrivances, is entirely thrown away.

The covering of the face of the hammer was formerly of buff leather; now it is made of a fine kind of felt, prepared expressly for the purpose, which gives a much superior quality of tone, and is much more regular in its structure. The change was first made by M. Pape, of Paris.

We have said nothing, hitherto, of the "damper," a simple contrivance for stopping the vibrations of the strings, when the fingers are lifted from the keys. It consists of several folds of soft cloth, which press against the string when at rest, but are lifted off by the back end of the key when the front end is pressed down. The grand piano-forte damper consisted, originally, of a simple rod, headed with cloth, and rising vertically between the strings. But little alteration has been made in this, except that, as the strings were made heavier, and the vibration became stronger, the force with which the damper was held against the string, required to be increased, and the damping surface of cloth extended. The dampers are sometimes made to act above the strings, sometimes below them. Either plan appears to act equally well; but the former is the more simple of the two, as the damper then is raised directly by the end of the key, and is kept down by its own weight; while, on the other plan, the intervention of a lever and spring is necessary. The damper of the square piano has undergone more frequent changes. At first, it was a wooden lever, lying horizontally over the strings, having a bit of cloth at one end, and lifted by a vertical sticker. Next, a variety was introduced by Messrs. Broadwood, called

the "brass damper," a brass lever acting under the strings, the weight of one arm of which kept it in action. Thirdly, came the "Irish damper," an upright one, worked directly from the back end of the key, which was soon modified into the "crank damper," by attaching it to a separate lever below. In 1827, Messrs. Collard patented an arrangement, in which the vertical wire was made to rise at some distance behind the strings actually struck, the head being elongated this distance forwards. In the old system, the damper wire, rising close by the side of the vibrating strings, was apt to jar against them—an evil which this improvement removed. The setting back of the damper wire also gave room for adapting the check (formerly used only in the grand action) behind the hammer, and thus originated the improved form of instrument called the "grand square." In common squares, the old crank damper is still used.

The manufacture

of piano-fortes forms an important branch of industry in the metropolis. The London Directory for 1851 enumerates nearly 200 piano-forte makers; but it must be explained that all these are not *bonâ fide* manufacturers, many being workmen in some single branch only of the trade; while others are proprietors of music shops, who lend their names to the instruments they sell. In addition to the above, there are also about fifty names of persons under separate branches of the trade, such as piano-forte key makers, hammer and damper cloth makers, hammer rail makers, fret cutters, pin makers, silkers, string makers, and tuners.

We have been unable to discover any published account on which we can rely as to the statistics of the trade in this country; but from enquiries instituted in the best quarters, we are enabled to give the following information, as a tolerable approximation to the truth.

It is estimated that the number of piano-fortes manufactured in London is about 450 per week, or upwards of 23,000 per annum. Some of the largest houses make from 1,500 to 2,500 per annum each, or one-tenth of the whole. Of the annual make, between 5 and 10 per cent. may be estimated of the grand form; about the same of the square; and the remainder, forming by far the largest portion, of the upright form.

The prices of instruments, made by the best houses, in lain mahogany cases, are, for grands, 125 to 135 guineas; for bichord and small grands, 80 to 105 guineas; for grand

squares, 50 to 100 guineas; for plain squares, 35 to 50 guineas; for cabinets, 75 to 85 guineas; for cottage and other small uprights, 45 to 70 guineas. These prices are often, however, increased for more expensive cases, in rose or other fancy woods, enriched with ornamental carving or inlaying. Beautiful specimens of such will be found in the Exhibition. Messrs. Collards' principal instrument is valued at 500 guineas; Messrs. Erard's at 1000 guineas; and Messrs. Broadwoods' at probably a higher price still. The enormous money value of these is solely on account of the external decoration;—as musical instruments, they are in no wise superior to the ordinary grands, sold at the prices above named. On the other hand, a class of instruments has been lately introduced by Messrs. Collard, with the laudable object of bringing the price of the ornamental part down to the lowest possible sum; and so putting piano-fortes of the best make within the reach of purchasers with limited means. With this view, the most useful variety of the small upright is made in a neat plain case of deal or other cheap wood, and sold for about 30 guineas. The appearance is better than would be supposed from the description: a specimen may be seen in the Exhibition. Low uprights, by small makers, are sold at much less prices than those of the best houses.

Multiplying now the number of instruments by their average price, we may obtain an approximate estimate of the gross annual return in the London trade. In fixing the average prices from those above given, it must be considered, on the one hand, that they should be increased for the number of more expensive cases; on the other, that the prices of many makers, particularly for upright pianos, are less than those of the first-rate houses. Probably the following will not be far from the truth.

Estimate of piano-fortes annually made in London.

1,500	grands, bichords, and small grands, at, say	£110 each	=	£165,000
1,500	squares	60 ,,	=	90,000
20,000	uprights, of various kinds	35 ,,	=	700,000
23,000		Total value		£955,000

or nearly a million per annum.

The number of workmen engaged in the piano-forte trade in London may be estimated at between 3000 and 4000. Comparing this with the number of piano-fortes, we find about six or seven instruments made in a year by an amount of labor equivalent to that of one man. In the larger houses, how-

ever, where the more expensive kinds are made, the proportion will be less;—say about four or five to a man.

The extent of the piano-forte manufacture in France is only about one-third that of England. In 1849 the gross value of the instruments produced was ascertained to be something above 8,000,000 francs, or £320,000.

The German manufacture is probably very large indeed, in consequence of musical education being more generally afforded than in other countries. We have, however, no means of giving any estimate of its amount.

In piano-forte making, as in many other trades where precision of detail is an important object, the principle of the division of labor is adopted to a considerable extent. As an example of this it may be stated, that a grand piano-forte, in the course of its progress to completion, goes under the hands of upwards of 40 different workmen; each of whom is occupied, with his assistants, in a special branch of the manufacture. The process of making an instrument of this kind may be briefly described as follows:—

In the first place, many of the parts are prepared separately, previous to the construction of the body of the instrument itself. For instance:—

1. The *key-maker* forms the entire key-board from one piece of lime-tree wood; fixes on the pieces of ivory and ebony; bores the necessary holes; and, finally, cuts the whole up into separate keys with a fine saw.

2, 3, 4, 5. The *hammer-maker*,—the *check-maker*,—the *damper-maker*, and the *damper-lifter-maker*, construct the parts of the action to which these names refer.

6. The *notch-maker* covers, with doe-skin and cloth, the notches or ends of the hammer-shanks into which the hoppers work.

7. The *hammer-leatherer* covers the hammer-heads with their different coats of leather and felt, and cuts them to their proper size.

8. The *beam-maker* makes the mahogany beam or rail, extending across the action, and covered with brass, in which the hammers are centered.

9, 10, 11. The *brass stud-maker* and *brass bridge-maker* form the upward bearing-studs and bridge; and the *wrest pin-maker* maker the iron tuning-pins.

12, 13, 14, 15. The *metallic brace-maker*,—the *metallic plate-maker*,—the *steel arch-maker*,—and the *transverse bar-maker*,—all construct parts of the metallic bracing.*

16. The *spun string-maker* makes the lapped or spun wires.

These parts, and other minor preparations, being supposed ready, the body of the instrument is made as follows:—

17, 18. The *sawyer* saws the timber roughly into shape; the *bent*

* The makers of the iron and brass-work, for piano-fortes and other musical instruments, are called *music smiths*.

side-maker then cuts it more accurately to its size and thickness, and bends, by a steaming process, the pieces destined to form the curved side of the instrument.

19, 20. The *case-maker* fashions, puts together, and veneers the timber framing forming the principal body of the instrument; he also forms and fixes the wrest-plank. The *bracer* inserts the timber cross-bracing in the frame; this is, however, sometimes done by the case-maker.

21. The *bottom-maker* makes and fixes the framed bed, at the lower part of the instrument, to receive the key-board.

22, 23. The *sounding-board-maker* selects the timber for, cuts out, and joints, the sound-board. The *belly-man* planes it to its proper thickness, shapes it, finishes it, and fixes it in the case. He also forms and fixes upon it the beech bridge, upon which the strings take their bearing.

24. The *marker-off* has more to do than his name implies. He marks out the scale for the strings, fixes the pins in the beech bridge, and finishes it to its proper shape; he inserts the upward bearing-bridge and studs in the wrest-plank, and bores it ready to receive the tuning-pins; he also fits and fixes the metallic string-plate, longitudinal stretcher-bars, and other parts of the metallic bracing, by which the piano-forte is made ready to receive the strings.

25. The *stringer* puts on the strings, and fixes the wrest-pins in their places.

26. The *finisher* receives the keys and the various parts of the action from their respective makers; he constructs the action-framing, puts the action together, fixes it in its place, and brings the whole of the mechanism generally into playing order.

27, 28. The *rougher-up* then tunes the instrument for the first time, stretching the strings to their proper tension; after which the *tuner* puts it thoroughly and permanently in tune.

29, 30. The *regulator of action* then examines and carefully adjusts every part of the action, and completes the regulation of the touch; and, finally, the *regulator of tones* examines the tones and corrects all irregularities, making the piano-forte sound perfect throughout.

The following operations, which have reference to the external part of the instrument, are done at various times in the course of its construction:—

31, 32. The *top-maker* constructs and veneers the cover, and puts on the hinges. The *plinther* fixes and veneers the plinth.

33. The *fronter* shapes, hinges, and centres the fall or cylinder front; shapes the checks, makes and fixes the mouldings, puts on the locks, and attaches the ornaments.

34. The *canvas frame-maker* makes an open wood framework, covered with canvas, which is fixed in the bottom of the instrument.

35. The *lyre-maker* makes the lyre-shaped bracket, fixed under the instrument to carry the pedals.

36, 37. The *leg block-maker* makes and fixes the blocks into which the legs are screwed; and the *leg-maker* makes the legs themselves.

38, 39, 40. The *turner*, the *carver*, and the *gilder*, do all work wanted in their respective departments.

41, 42. The *scraper* scrapes and cleans the surface of the case, and prepares it, by rubbing it with glass paper, for the *polisher*, who gives it its coat of French polish.

It is almost superfluous to add, that all the hands employed in the manufacture must be well skilled in their respective departments; and that the whole of the operations (but most particularly those connected with the framing and action) must be done with the utmost care, or a good result cannot follow. It is moreover found necessary, in order to ensure the good quality of the instrument, that the work be not hurried, but that it should progress slowly and gradually to completion. A grand piano-forte usually remains in hand upwards of six months.

The following table gives a list of the different materials required in the construction of a piano-forte, specifying the parts of the instrument where they are used:—

MATERIAL.			WHERE USED.
Woods.			
Oak	from	Riga	Framing, various parts.
Deal	„	Norway	Wood bracings, &c.
Fir	„	Switzerland	Sounding-board.
Pine	„	America	Parts of framing,—key-bed or bottom.
Mahogany	„	Honduras	Solid wood of top, and various parts of the framing and the action.
Beech	„	England	Wrest-plank, bridge on sound-board, centre of legs.
Beef wood	„	Brazils	Tongues in the beam, forming the divisions between the hammers.
Birch	„	Canada	Belly-rail, a part of the framing.
Cedar	„	South America	Round shanks of hammers.
Lime tree	„	England	Keys.
Pear tree	„	„	Heads of dampers.
Sycamore	„	„	Hoppers or levers, veneer on wrest-plank.
Ebony	„	Ceylon	Black keys.
Spanish Mahogany	„	Cuba	For decoration.
Rosewood	„	Rio Janeiro	For decoration.
Satin wood	„	East Indies	For decoration.
White holly	„	England	For decoration.
Zebra wood	„	Brazils	For decoration.
Other fancy woods			For decoration.
Woollen fabrics.			
Baize;—green, blue, and brown			Upper surface of key-frame, cushion for hammers to fall on, to damp dead parts of strings, &c.
Cloth, various qualities			For various parts of the action, and in other places to prevent jarring; also for dampers.
Felt			External covering to hammers.

MATERIAL.	WHERE USED.
Leather.	
Buffalo	Under covering of hammers,—bass.
Saddle	Ditto ditto,—tenor and treble.
Basil	Various parts of the action.
Calf	Various parts of the action.
Doeskin	Various parts of the action.
Seal	Various parts of the action.
Sheepskin	Various parts of the action.
Morocco	Various parts of the action.
Sole	Rings for pedal wires.
Metal.	
Iron	Metallic bracing, and in various small screws, springs, centres, pins, &c. &c., throughout the instrument.
Steel	Metallic bracing, and in various small screws, springs, centres, pins, &c. &c., throughout the instrument.
Brass	Metallic bracing, and in various small screws, springs, centres, pins, &c. &c., throughout the instrument.
Gun metal	Metallic bracing, and in various small screws, springs, centres, pins, &c. &c., throughout the instrument.
Steel wire	Strings.
Steel spun wire	Lapped strings.
Copper covered wire	Ditto,—lowest notes.
Various.	
Ivory	White keys.
Black lead	To smooth the rubbing surfaces of cloth or leather in the action.
Glue (of a particular quality, made expressly for this trade)	Woodwork throughout.
Bees' wax, emery paper, glass paper, French polish, oil, putty powder, spirits of wine, &c. &c.	Cleaning and finishing.

The materials must all be of the best possible kinds. The timber especially, being the most important, must be selected of the soundest quality;—it requires to be thoroughly seasoned (a process often of several years), and must then be dried by artificial heat before it is worked for use. A similar degree of care must be taken in the selection and preparation of all the other materials, or the quality of the instrument will suffer.*

Notwithstanding the great intelligence and care that are brought to bear on the manufacture of piano-fortes, we doubt whether the aid of science has been called in to the extent that could be wished, to guide their construction. Arrangements are often seen, which appear unwarranted by the principles of mechanics; and, generally speaking, the *engineering* of the construction is not so well studied as it ought to be. But, in the application of acoustical science, piano-forte making is yet more behindhand. The theory of the production of tone, at least as regards its quality, is at present wrapt in mystery; few persons seem to have any definite idea what

* For the particulars in the text we are indebted to the courtesy of Messrs. Broadwoods.

are the essential conditions under which "a good tone" in general, or, still less, any particular quality of tone, can be ensured. A series of tentative experiments leads to certain methods of construction which are considered good; and all possible care is then taken to avoid defects in the manufacture; but the result is, after all, frequently due to some fortuitous combination of circumstances, which cannot be foreseen. Hence arises the variety in the qualities of tone, not only of instruments by different makers of equally good repute, but also in those turned out from the same house, and made apparently in precisely the same manner. Nay, even in the same piano-forte, it frequently happens that the practised ear can detect considerable variations;—sometimes a certain portion of the scale may be far superior to the rest; sometimes a few notes here and there may be deficient in resonance; sometimes one note only in the whole instrument may be faulty; but the reason for these anomalies it is impossible to explain.

The general excellence of a piano-forte depends, however, not only on the design of its various parts, but also, as we have already stated, on the quality of the materials, and the amount of care bestowed on the workmanship. It is due principally to the great attention paid to these latter points by the chief London houses, that English piano-forte making has obtained, and still retains, its high reputation.

If there is any one point to which, in preference, future attention should more particularly be directed, we think it is the *cheapening* of the better classes of instruments. A hundred and twenty or thirty guineas for a grand is a price altogether beyond the reach of multitudes, who both need and know how to appreciate a good piano. And yet the tendency of late has been rather to increase than diminish the cost. We admit readily, that a piano-forte, made purposely to attain the highest possible grade of perfection, must always bear a high price; but, at the same time, it is but reasonable, that means should be found to bring a class of instrument, equal to the ordinary grand, within the reach of persons by whom it is now quite unattainable. The expediency of combining cheapness with excellence in quality has long been acknowledged and acted upon in almost every other branch of manufacturing art; and indeed seems to be the ruling principle of commerce in the present day. It is beginning, though tardily, to extend itself to the piano-forte manufacture; and we hope, for the sake of the art, that the time may soon come when its influence will be more general.

PIANO-FORTES IN THE EXHIBITION.

That this branch of industry is fully represented in the Exhibition, will be seen from the following table, which gives both the number of exhibitors, and of piano-fortes exhibited.

	Exhibitors.	Piano-fortes exhibited.
Great Britain	38	68
France	21	44
Belgium	6	14
Germany (Zollverein, &c.)	18	24
Austria	5	5
Switzerland	3	3
Denmark	1	2
Russia	1	2
United States	6	9
Canada	2	2
Total	101	173

In our notice of these instruments we shall confine our remarks to explaining, and commenting on, the novelties or peculiarities observed in their construction. We think this course more suited to the object of the present series of papers, than it would be to express opinions on the tone, or on the comparative excellence, or otherwise, of the various specimens exhibited. Such opinions, however just or impartial, might still be open to cavil, and would after all be of little practical utility; while facts, bearing on the construction, must be always interesting and valuable.

Great Britain.

Commencing with British exhibitors, we find that Messrs. Addison and Co. have contributed a piccolo upright, called the "Royal Albert transposing piano-forte." The object sought is to transpose vocal music, so as to suit voices whose compass would not allow of their executing it in the original key. For example, if a song be played on the keys as if in C, it can be made to sound either in the key of C sharp, D, E flat, B, B flat, or A,—*i. e.*, in any key within a range of three semitones above or below the original one. There are other contrivances for this purpose in the Exhibition; but in all these, either the key-board and action, or the strings and framing, are shifted laterally, so as to make one hammer strike different strings, according to its position. In the present, neither action nor strings are moveable. The keys may be described as divided at half their length, the front and

back ends being capable of moving independently of each other, and the connection being made between them by means of a shifting lever underneath; so that, by altering the position of this lever, the front end of the key C, for example, may be made to act on the back end of either of the keys C sharp, D, B, B flat, &c. A model of the movement accompanies the piano-forte. We cannot see that this plan has much advantage over the others; while it is certainly more complicated and expensive, and must inevitably deteriorate the touch. The transposing piano-forte is an old contrivance, having been made by Messrs. Broadwood, under patent, thirty years ago. It has, however, never been much used, and probably never will be. It can only be of service to players of an inferior class; for to better musicians, having a proper perception of pitch, it would be torture to have the fingers playing in one key, while the ears are impressed with another.

Mr. Akerman, of Bridgewater, exhibits a cottage upright, called a "lyric grand," from its back being formed like a lyre; it has three strings to each note, placed obliquely.

A piccolo upright, by Messrs. Robert Allison and Co., has this peculiarity, viz., that the colors of the keys, instead of being arranged in the ordinary progression, are divided in the following manner:—

C	*Grey*
C sharp	White
D	*Grey*
D sharp	White
E	*Grey*
F	White
F sharp	*Grey*
G	White
G sharp	*Grey*
A	White
A sharp	*Grey*
B	White
C	*Grey*

and so on, repeated throughout the instrument. It thus forms what is called a "diapason* scale indicator;" and its use is to indicate to learners the notes necessary to form the diatonic major or minor scale, in any given key. The rule is, commencing with the key note and ascending:—

To form the major scale, take three successive keys of the same color, and four of the other color.

To form the minor scale, take two keys of the same color, and five of the other.

It is almost needless to add, that this contrivance is more

* Query *diatonic?*

curious than useful, and cannot be intended to apply to piano-fortes generally.

The factory of Messrs. Broadwood and Sons contributes four full-sized grands, 7 octaves, G to G. These have the repetition action, and all the latest improvements. They are all alike, except in the external decoration, and in regard to some few differences in the construction of the metallic bracing. Two of them have three bars parallel with the strings; one has one parallel bar and one placed diagonally; the other has one parallel and two diagonal bars,—the latter lying at different angles. They have all the long transverse bar over the wrest-plank. They are excellent specimens of the grand piano-forte, in its most perfect modern state.

Mr. Cadby exhibits one grand, 7 octaves, C to C, and two cottage uprights, fitted with his "patent suspended and adjustable sound-board." In ordinary instruments, the edges of the sound-board are glued firmly to the framing of the instrument. The patentee considers this has the effect of destroying the brilliancy of the tone, owing to the fact, that the sound-board is not strained tight; he therefore secures it to the framework solely by metal clamps, in such a manner as to admit of its being strained and tightened when desired, like the parchment head of a drum.* In the grand piano-forte exhibited, the framing carrying the strings is separate from the case of the instrument, and may be removed from it entirely.

Messrs. Collard and Collard contribute one grand, 7 octaves, A to A, with all the latest improvements, and one grand square, 6½ octaves, C to G, of a peculiar kind, called by the makers, for distinction, the "square semi-grand." Its peculiarity is, that it has precisely the same action as that used for semi-grands; whereas the ordinary grand square has only an adaptation of the peculiarities of the grand action to that of the common square. A cabinet and two microchordons, or small uprights, 6½ octaves, C to G, are also exhibited. One of the latter is the cheap kind of instrument already alluded to; it has a case of varnished Swiss pine. The whole of these instruments are first class of their respective kinds, and afford favorable examples of the most improved English manufacture.

Messrs. Ennever and Steedman exhibit a cottage upright, 6¾ octaves, C to A, in highly decorated case. The keys (made by Messrs. Brookes) are of pearl and tortoiseshell, in-

* For specification of this invention see p. 319, Vol. XXXVIII. of Newton's London Journal.

stead of ivory and ebony. We think this is a mistake, as the variegated shades must disturb the eye of the player.

A full-sized grand, 7 octaves, A to A, is exhibited by Messrs Erard; the peculiarity of which is, that in addition to the metallic string-plate and longitudinal tension-bars, the wrest-block is also of metal, being formed of a framework of brass, in which is fixed a strip of beech wood to receive the wrest-pins. This, in conjunction with the longitudinal bars and the string-plate, form an entire metallic framing, extending from one end of the instrument to the other. Entire frames of metal have previously been used for upright instruments, and grands and squares, with entire metallic frames, are exhibited by American and Danish manufacturers; Messrs. Erard have, however, a patent for their peculiar method of application. We are inclined to fear that there is a growing tendency to use too much metal in the construction of piano-fortes. Up to a certain point it may, no doubt, be very valuable for its strength-giving powers; but there will probably be found a limit beyond which it may be injurious to the quality of the tone; it undoubtedly would be so if used to any extent in the violin tribe, whose resonance is produced in a way very analogous to that of the piano-forte. It must be considered also that so much metal adds greatly to the weight and the cost of the instrument, and diminishes proportionately its portability and general usefulness.

Another full-sized grand, by the same house, 7 octaves, A to A, has a pedal clavier, similar to that of an organ. The pedal notes act on the lower notes of the piano, and have a compass of about two octaves. This is not new, as organ builders and organ players have frequently adapted pedals to piano-fortes; and, some years ago, Messrs. Coventry and Hollier, of Dean-street, Soho, sold piano-fortes with pedals attached. We must say, however, that Messrs. Erard's adaptation is superior to any former ones we have seen. Many of our readers probably know, that the attainment of proficiency in organ playing requires great practice with the pedal clavier; and, since practising at churches is very inconvenient, it is obvious that an arrangement of piano-forte pedals for the chamber would be of service to organists; but if, as we understand, the cost of the addition, as made by Messrs. Erard, amounts to nearly 30 or 40 per cent. extra on the price of the piano, we fear its use will be much circumscribed.

A small upright, 7 octaves, A to A, by Messrs. Erard, differs in many respects from the ordinary English con-

struction. In the first place, it has three strings to each note; whereas most English pianos of this kind have only two. Secondly, the strings, instead of being placed vertically, run obliquely across the instrument, by which a greater length is gained without increasing the height of the case.* Thirdly, it has a metallic bracing in front of the sound-board, on the same principle as that applied to the grand form. Fourthly, it is provided with a new repetition action, lately patented by this firm. Fifthly, it has a soft pedal acting in a peculiar way. The ordinary method of producing the soft tone in grands and uprights, is by shifting the action, so that the hammers strike only two strings instead of three, or one instead of two. Now this is inconvenient to accomplish where the strings run obliquely; and therefore the soft effect is here produced by interposing a piece of soft cloth between the hammer and the string, which deadens or softens the blow. It is an old French invention, and was originally called the "*jeu céleste;*"—its effect is pleasing; and it avoids the tendency to throw the piano-forte out of tune, which is often the result of giving the blow to one string.

This firm also exhibit a peculiar method proposed for the attachment of the tuning end of the string. In this, the ordinary wrest-pin is omitted, and replaced by a nut or female screw, to which the end of the string is attached, and in which a fixed screw works. By applying the tuning key to turn this fixed screw, the nut attached to the string may be drawn or relaxed (according to the direction in which the tuning key is turned), and the pitch raised or lowered at pleasure. This plan is by no means new; it was adopted by a Mr. Lewis about a quarter of a century ago; and we have seen drawings and models of his instruments, shewing the arrangement precisely as now revived by Messrs. Erard. The evils of the ordinary wrest-pins are stated to be, that they require considerable force to turn, and become in time liable to slacken and let the piano-forte go out of tune. These are not of so much weight as is generally supposed; the latter objection, however, increases in importance, as the strings are made thicker, and the tension is consequently greater; and this is further enhanced by the heavier blows given in modern piano-forte playing. The ordinary friction

* This is a very old plan, having been patented by Mr. Wornum about 1810. The piano, thus made, was called the "unique," and was the first low variety of the upright form. Several hundreds were made by the firm of Wilkinson and Wornum.

wrest-pin is, it must be confessed, a primitive contrivance; but its extreme simplicity has retained it in use. If a firmer method, equally simple, could be devised, it would doubtless be an improvement; but we do not think the plan exhibited by Messrs. Erard is the most advisable. There are other modes to be seen in the Exhibition for attaining the same object; and we shall notice them in due course.

A horizontal piano-forte, by Mr. Greiner, termed, we suppose, a bi-chord grand, but which is in reality unlike any instrument hitherto made, calls for special remark. Its strings lie in two planes, slightly inclined to the horizontal, and to each other, and intersecting at the front end of the instrument; their farther ends opening out into something like the shape of a trumpet. The idea of the inventor is, that this shape will throw the sound out horizontally, and make the instrument better heard than on the ordinary plan; but we cannot think that any advantage of this kind will compensate for the awkwardness of the form, and the difficulties attending its manufacture. A second novelty in this instrument is what the inventor calls the unison method of tuning. One wire forms the two strings of each note; it is looped at its two ends to two adjoining pins in the string-plate at the back of the instrument, and its centre is turned over a cylindrical stud at the front. This front stud is capable of being moved backwards and forwards by a screw, by which the two halves of the wire are tuned simultaneously. In order to adjust the two strings to a unison, the front cylindrical stud is moveable round its centre by means of a lever, which gives the power of tightening one half of the wire and slackening the other, until a perfect unison is obtained. Of course this method of stringing is not applicable where three strings are used. A third novelty is in the action, called a repeating check. It is a means of producing the repeating power by a small tongue of leather attached to the check, and jointed, so as to move upwards with perfect ease, but to offer resistance to motion in the contrary direction. By this arrangement the hammer is allowed to rise without obstruction; but when it tends to fall, it is held up by the leather tongue till the hopper engages, and thus the repetition is secured. This is one of the simplest contrivances for the purpose we have seen. Mr. Greiner also exhibits a model of a new method of stringing, by which two strings are made to vibrate by a blow given to one only, on the same principle as the synchronous vibrations of the two arms of a tuning fork.

Messrs. Harrison & Co. exhibit a piccolo upright, called

the "utilitarian boudoir piano," and made with the object of constructing a piano-forte at the least possible cost; the price of this instrument being eighteen guineas only. To effect this, several alterations have been made. In the first place, there is only one string to each note; secondly, the keys are shorter and project less, by which the legs or scrolls usually put under the key-frame are saved; and, thirdly, the action consists of a simple projection at the end of the key, which lifts the tail of the hammer directly, without the intervention of any hopper. It is in fact a return to the primitive single-action, with which the piano-forte was first made; the only difference being the variation in form necessary to apply it to the upright instrument. Although advocating cheapness, we cannot consider it desirable to obtain it by depriving the piano-forte of the improvements it has received, or by any other means calculated to deteriorate its quality.

A cottage upright, by Mr. Harwar, has the power of transposing. The framing, carrying the sound-board and system of strings, is detached from the case, and is capable of being moved laterally upon rollers, by turning a screw at the side. When the frame is shifted more or less to the right, the key C will strike either B, B flat, or A, according to the distance through which it is moved; or, by shifting it to the left, the same key will strike C sharp, D, or D sharp, and so on. This piano-forte has also metallic bracing at the back, to counteract the pull of the strings.

Mr. Hopkinson exhibits a grand, with a new action, called "the patent repetition and tremolo check action;" but as the mechanism is not shewn, we can merely remark that it is intended to give such an extreme degree of repeating power, that a kind of tremolo may be produced by slightly agitating the key when down. The dampers consist of wedges of soft cloth, on the German plan.

A cottage upright, of a peculiar shape, called the "Lyra piano-forte," is exhibited by Messrs. Hund and Son. The back of the instrument is intended to be turned towards the centre of the room, and is formed like a lyre, with openings covered with silk; the object being to throw the sound outwards. The piano stands on a raised platform or sound conductor, into which the bass strings descend, and which also elevates the stool for the player. There are three pedals, the additional one being a soft one on the French principle, viz., introducing a thickness of soft cloth between the hammer and the string.

Messrs. Jenkins and Sons shew a cottage upright, on the "patent expanding and collapsing" principle. The key-frame of this instrument turns down on a hinge, shutting into a recess formed for it below; so that, when not in use, the space of its projection may be saved. When thus shut up or "collapsed," the depth of the instrument, from back to front, is only 13½ inches. It is intended principally for use on ship-board.

A "twin" piano-forte, by Messrs. Jones and Co., is peculiar in its construction, but of doubtful utility. It is a double instrument, and may be described as two piccolo uprights, placed back to back, with the important difference, however, that the same framing is made to serve for both, by placing a sound-board and system of strings on each side.

Messrs. Kirkman and Son contribute a grand, 7 octaves, A to A, and a bichord ("fonda") grand, 6¾ octaves, C to A, of the usual construction; also a low upright, 6¾ octaves, C to A, with three strings to each note, placed obliquely, and having also metallic bracing-bars in front of the sound-board.

The same firm also exhibit a model of a bichord grand, perfect in its construction in every respect. It has a compass of 6¾ octaves, C to G, and every note sounds the same pitch as the full-sized instrument. It has metallic bracing and string-plate, upward bearing, grand check-action, pedals, and all modern improvements. The following table of dimensions of this model and the real instrument will shew its comparative size.

	Dimensions of ordinary Bichord Grand.		Dimensions of Messrs. Kirkmans' Model.	
	Ft.	In.	Ft.	In.
Outside length	7	0	4	1
" width	4	3	2	10
Height from the ground to top of instrument	3	2	1	8½
Length of key-board	3	7½	2	2½
" each octave	0	6½	0	3 15/16
Depth of the keys from front to back	0	5⅝	0	3½

The tone of this lilliputian instrument is wonderful for its size, and the workmanship throughout is perfect.

In the mediæval court, Messrs. Lambert and Co. exhibit a cottage upright, for its decorative qualities. The white keys are inlaid with an ornamental device, and the sharps are of tortoiseshell. We have already stated an objection to this kind of decoration.

Mr. Matthews, of Nottingham, exhibits a piccolo upright, with "patent propeller action"; the peculiarity of which consists in the so-called "stickers," and certain other parts of the action being made of metal instead of wood; one of the objects of the alteration being to interpose less material before the strings, and therefore to offer less obstruction to the passage of the sound.

Mr. Mott exhibits a grand, $7\frac{1}{2}$ octaves, F to C, with a seraphine of 5 octaves applied thereto under the front part of the instrument, and thus forming two claviers. A solo may be performed on one of them, and an accompaniment on the other; or, by means of couplers, they may both be played together.

A grand, $6\frac{3}{4}$ octaves, C to A, by Messrs. Stodart, is a very interesting specimen, inasmuch as it is fitted with metallic bracing on the plan patented by Mr. Stodart in 1820. This is the original of all the varieties of metallic bracing now in use, and its leading features—viz., a metallic string-plate kept apart from the wrest-plank by a system of longitudinal metallic bars — are essentially the same as have ever since been followed. The only variations from the more modern systems in matters of detail are, that the longitudinal stretchers are hollow tubes instead of flat bars, and that the string-plate is detached from the wood framing below. With regard to the form of the stretcher, there is no doubt the hollow tube is the more correct form, on mechanical principles, as being better calculated to offer the greatest resistance to a compressive force with the least quantity of material. Every one acquainted with constructive science knows that a hollow tube is the most advantageous form for a column, and the function of the metallic stretchers in a piano-forte is precisely analogous. The object of leaving the string-plate detached from the woodwork below, was to allow the whole metallic frame, with the strings it carried, to contract and expand together, under atmospheric changes, without straining the woodwork, since wood and metal are, it is well known, differently influenced in this respect. The experience of other makers has not shewn this to be of much importance in practice; and therefore the separation of the wood and metal framing is but seldom adhered to; but the idea is ingenious, and the principle correct. Altogether Mr. Stodart's system of metallic framing, adopted at such an early date, is a good example of the application of scientific knowledge to the construction of the piano-forte; and the very general way in which it has been since followed, corroborates the universal

rule that improvements, based on correct principles, are those which will ultimately be found of the greatest practical value. A peculiarity in the framing of this piano-forte, although not a part of the original system, is that the wrest-plank is turned upside down, being placed above the strings instead of below them; by this arrangement, the strings are struck against their rests, without the necessity for an upward bearing stud; while the metallic stretcher-bars bear directly against the plank instead of being cranked down to it, as in the common plan. The wrest-pins pass completely through the plank, and their squared ends appear above it, so to offer facility for tuning. The inverted wrest-plank is a remnant of a system introduced by Mr. Wornum, in which the entire wood framing was placed above the strings; but which, from its inconvenience, has not continued in use.

The same firm also exhibit a square, 6¾ octaves, C to A, with a down-striking action. This example shews satisfactorily how much the framing of the square piano-forte might be simplified and improved by the substitution of the inverted mechanism. The action has an improvement by Mr. Greiner, by which the necessity for springs is done away We believe that Mr. Stodart introduced the down-striking square four or five years ago, and is the only English maker who has manufactured instruments on this principle. This piano is six or eight inches shorter than ordinary squares; wherefore the maker has called it the "compact square." Moreover the key-board is in the middle of the length; and the appearance is therefore symmetrical. This has also been done by Messrs. Collards.

A bichord grand, made by Messrs. Towns and Packer, has the power of transposing through a range of four semitones above or below the original key. It has, for this purpose, an arrangement for shifting the key-board and action in a lateral direction. This is the original way in which the transposing piano-forte was made.*

Mr. Woolley, of Nottingham, exhibits two piccolo uprights, 7 octaves, C to C. These have three vertical strings to each note, and have a bracing behind the frame, called the "patent equilibrium," for taking the tension of the strings.

Mr. Wornum contributes a small bichord grand, called the "Albion" grand. The peculiarity of this instrument is, that it has a down-striking action, patented by the maker in 1842. There is no metallic bracing to this piano, and it affords a good example of how much the introduction of the down-

* Vide remarks on Mr. Addison's piano-forte, *ante*.

striking principle would simplify and cheapen the instruments of this form, as Mr. Stodart's does in reference to the square. A piccolo upright, 6¾ octaves, C to A, by the same maker, is a good specimen of the first form of low upright, with vertical strings. The peculiar action of the piccolo, patented by Mr. Wornum, in 1829, has been extensively followed by foreign makers.

France.

The French manufacturers have contributed to the Exhibition seven grands, one square, one cabinet, and several low uprights. The latter are principally with three strings to each note, some having, however, four strings in the treble part of the instrument. The inclined disposition of string is very common; a few have strings crossed in two planes; and some are fitted with metallic bracing. The *jeu céleste* soft pedal is much used; and several of the instruments transpose, by shifting the keys. The only specimens that need particular mention, are the pianos of M. Henri Herz, and of M. Pape, and the "piano mécanique" of M. Debain.

M. Herz sends three instruments,—a grand, a semi-grand, and a "piano-éolien."

The grand and semi-grand are constructed on a principle patented many years ago in England by Mr. Wornum, and already alluded to in page 32. The keys and action are in the usual position; but the framing and sound-board are placed above the strings, by which the effect of a down-striking blow is obtained: the system may indeed be described as a down-striking instrument turned upside down. Many pianos were made in England on this plan; but it was ultimately abandoned by its inventor as too inconvenient for general use. M. Herz introduces however a novelty, in placing the strings obliquely, with the view of gaining length for the bass notes, without increasing the size of the case. This causes a variation in the form;—the semi-grand is of a triangular shape, somewhat like the ordinary ones, but with the long side on the right hand of the player; the grand is curved symmetrically on both sides.

The "piano-éolien" contains an addition to the piano-forte, the object of which is to sustain and graduate the tone, without having recourse to pipes, reeds, or any vibrating bodies other than the string. The principle (an invention of M. Isoard, an engineer and mechanician) consists in causing a current of air to act on the string immediately on its being struck, which prolongs its vibration somewhat on the principle

of an eolian harp. For this purpose there is an opening opposite to each string, through which a stream of air passes from a bellows, when a valve, corresponding to the given note, is opened by the key. The bellows are moved by pedals, in the same manner as those of a seraphine. It is stated that the sound will continue as long as the valve remains open; and that, by giving to the pedals a greater or less degree of pressure, any *nuances* of *forte* or *piano* may be given to the tone. The string here serves the place of the reed of a seraphine, with the difference that it is fixed at its two extremities, instead of being free: the advantage over any combination of the reed with the piano is, that the two sounds, the struck and the sustained one, must always remain in perfect unison.*

M. Pape is an exhibitor in the French department. This maker is well known as having devoted the best part of his life to the study and practice of piano-forte making, and as having introduced probably more novelties in their construction than any other person. On this account, we shall make no scruple of entering somewhat at length into the description of his inventions. M. Pape exhibits five instruments;—a grand, a square, a table piano, a low upright, called a *piano console*, and an upright of peculiar shape, with long inclined strings.

The grand piano, as made by M. Pape, is on the down-striking principle,—the keys and action being placed entirely above the strings. The arrangement of the mechanism has, however, a remarkable peculiarity. In the generality of down-striking actions, the hammers are situated at the back end of the key-frame, and are moved by the back ends of the keys; in M. Pape's action, on the contrary, the hammers are placed under the keys, and are worked from their *front* ends, directly under the part struck by the fingers; so that the thrust passes immediately downwards, in a direction nearly vertical, from the finger to the hammer, and thence to the string below. The firmness which this direct action gives to the blow may be easily understood. Moreover, there

* We give this description from a pamphlet published by the maker, as, the instrument itself being locked up, we could not obtain the opportunity of examining it. The same has been the case in other instances; and we cannot help remarking, that this practice of sending articles to the Exhibition, and refusing to exhibit them, is evidently a gross violation of the privilege granted to exhibitors;—it tends to defeat the main object of the Exhibition,—to deprive it of its catholic and instructive character,—and to prostitute it into a mere vehicle for puffing advertisement. The provisional registration adopted by the government, renders this narrow-minded policy utterly inexcusable; and we think it deserves the severe censure of the Royal Commission.

is another great advantage attending this disposition of action, namely, that from the hammers being brought so far forward, a much greater length of string is obtained than on the ordinary plan, with the same length of case. In up-striking instruments (as well as in down-striking ones having the hammer at the back), the front end of the string must, of necessity, lie at some distance from the front end of the instrument; while in M. Pape's arrangement the string is brought completely up to the front, and thus an increase of about a foot in length is obtained, or, which is the same thing, an equal diminution in the length of the instrument for the same length of string. M. Pape states, that the principal inducement which led him to adopt the down-striking action was to avoid the opening for the hammers, and so to simplify the construction of the sound-board and framing,—parts so important to the tone and durability; they are, accordingly, continuous and unbroken throughout their whole extent, as in an upright instrument. There are, however, other important novelties in their arrangement. In the ordinary construction of pianos, of whatever form, the sound-board is glued firmly to the framing, on the same side of it as the strings, and immediately below them. Now, a little consideration will shew that the pull of the strings has a constant tendency to compress the sound-board; an effect which, when existing to any great extent, must inevitably deteriorate the tone. There is little doubt that the derangement of the sound-board, by the constant tension of the strings, is the principal reason why piano-fortes have generally lost their tone as they have become older; for we know, by the analogy of the violin, that, supposing all the parts to remain undisturbed, the effect of age ought rather to improve than to deteriorate* instruments depending on wood for their sonority. M. Pape gets rid of the evil above named, by placing the sound-board on the opposite side of the framing to that occupied by the strings. A strong open frame of cast-iron, or wood strengthened with iron, extends over the whole size of the instrument, forming the bottom of the piano; on the upper side of this the strings are stretched, and on the lower side is fixed the sound-board; by which arrangement the pull of

* It is worthy of consideration, however, that it is scarcely possible to compare the present tone of an old piano with what it originally was. To try it against a new piano is not fair; for as improvements are constantly being made, the quality of a new instrument must necessarily be superior to that of one made several years before. Hence, a piano-forte that retains its tone perfectly, might, by this criterion, be unjustly charged with deterioration.

the strings can have no tendency to compress the sound-board; but if any action at all is produced on it, it must be that of extension, which is beneficial rather than otherwise. The bridge, over which the strings pass (and which, in the ordinary construction, is glued upon the sound-board), is, in the new arrangement, a loose piece, communicating with the sound-board by sound-pegs, similar to that of a violin, which transmit the vibrations to the sound-board exactly in an analogous manner. Another advantage is obtained by this arrangement, viz., that the sound-board may be considerably enlarged. In the ordinary construction its size is bounded by the blocks and points of attachment of the strings to the framing; whereas, in this plan, no such limitation being necessary, the sound-board may extend over the whole surface of the instrument, by which increase of dimensions a proportionately greater resonance is obtained. This is of especial value in the small upright forms. Another alteration in the sound-board is in the position of the strengthening ribs; these are usually fixed on the side opposite to the strings; M. Pape places them towards the strings, which position he considers much more favorable, inasmuch as the strain tends to fix them more firmly instead of to loosen their ends, as on the ordinary plan. The sound-board is also made thicker and more solid than usual. M. Pape occasionally makes grands of the compass of 8 octaves, F to F; for these the new arrangement of sound-board gives the means of obtaining the requisite length for the lower notes, without increasing the size of the case beyond that of an ordinary grand.

The square, as made by M. Pape, has a down-striking action, and the same arrangement of sound-board as above described.

The table piano is an instrument having the size and appearance of an ordinary drawing-room table; one end being lifted up, the keys slide out in a sort of drawer, and the table is converted at once into a piano-forte. The action is down-striking like the grand, and the hammers are directly under the front end of the keys; the strings are brought up to the front, and cross each other in two different planes, by which the necessary length for the lower notes is obtained. The sounding-board extends over the whole instrument; and it is only by M. Pape's plan that sounding-boards of sufficient extent, and strings of sufficient length, to yield any tolerable tone, could be given to this small size of instrument. A table piano, of 6½ octaves, measures, on the top, only about 4 feet square.

The console upright is the smallest, the most elegant in shape, and the most effective for its size, of any of the vertical class of instruments we have seen. It has the appearance of a chiffonier, and stands little more than three feet high,—the top projecting, in fact, only a few inches above the box enclosing the key-frame. It has a compass of $6\frac{1}{2}$ or 7 octaves, and has three strings to each note, placed in an inclined position. It is in this instrument that the advantage of M. Pape's plan of framing is most marked, as the sound-board is made to extend over the whole vertical area of the instrument; whereas, in ordinary uprights, it is of necessity limited to the area occupied by the strings alone: on this account, the tone of the console piano is extraordinary for so small a size. The action is very simple and certain,—the hopper at the back end of the key acting directly upon the tail of the hammer.

Another piano, exhibited by M. Pape, is a low upright with lateral projections, by which room is gained for long strings, placed at a considerable angle with the vertical, something like a square set upright on its side. The maker's intention in this, is to give the power of a grand without occupying its horizontal space; but the form is ungraceful, and will not, we think, be approved.

There are some peculiarities common to all the varieties of action, as made by M. Pape, well worthy of imitation, but which have been little attended to by the majority of makers. All the parts are perfectly accessible; and every point liable to wear is provided with a mode of adjustment. For example, the grand action, although apparently buried in the case, can in a moment be turned round, and every part exposed to view; while the escapement, the effective length of hopper, the key-centre, and the front pinhole, the dampers, the height of the key, &c., have all adjusting screws, by which they can be regulated with the greatest facility when worn, or otherwise out of adjustment. By these means, all rattling of the keys and action, unevenness in the touch, imperfect damping, &c., which so often occur almost irremediably in old instruments, may be at once removed, and the mechanism restored to its original good condition. The key-centres, instead of working on a vertical pin, as commonly made, turn on a horizontal wire,—a plan more in accordance with mechanical rules, and less liable to derangement. We have elsewhere stated that M. Pape was the originator of the substitution of felt for leather in the covering of the hammers. This change not only improved the tone, but facilitated, in an important degree, the manufacture: the leathering was

a difficult operation, requiring much skill and care in the selection and application of the material; but when the woollen fabric took its place, it was applied with the greatest ease. The practicability of the change was no sooner shewn than its importance was acknowledged by its universal adoption.

The changes we have above described constitute but a small part of the novelties introduced by M. Pape into piano-forte making. He enumerates about 120 patents, taken by himself in France, for improvements in this branch of art; many of which have also been secured in England. It is possible that his results have not always been successful; but he cannot be denied the credit of a vast amount of originality, ingenuity, and practical skill, and deserves praise for the zealous manner in which he has applied these to the improvement of his instrument.

The *piano-mécanique* of M. Debain is an ingenious contrivance for playing by machinery, intended to supersede the barrels hitherto used, by a less cumbrous apparatus;—it is employed here for the piano-forte; but it is also capable of adaptation to the organ or seraphine; and an application to the latter is exhibited in the English department. Instead of the tune being pricked on a barrel, it is formed by a series of pins, fixed on the plane surface of a thin oblong tablet of wood, a few inches broad, giving to it something like the appearance of a currycomb. This is drawn, by a rack and pinion, through a frame, in which project wedge-shaped ends of levers, connected by rods with the hammers of the piano; so that, when any pin in the tune-tablet passes over one of these wedge-shaped lever ends, it depresses it, and thereby lifts the hammer, which, when the pin has passed over, is thrown back by a spring against the string. If the tune played is of considerable length, several tablets are passed through the frame in succession; while, if it is a repeating strain, such as dance music, &c., the same tablets are used again and again. The mechanical apparatus is made to fit on to the top of an ordinary cottage piano-forte, and may be detached at pleasure; leaving the instrument in its natural state for performance by the fingers. When the apparatus is applied, the usual hammers are drawn back, and the spring ones take their place, so as to strike the same points of the strings. The action of the machine is very good; and its execution appears to be certain and rapid. Its advantages over the barrel system are—greater portability, convenience, and cheapness, and its adaptability to ordinary instruments, without deranging their normal condition.

Belgium

sends one grand and thirteen uprights. The former is on the modern construction, and appears to have Erard's action. Nearly all the uprights have three strings to a note, sometimes placed obliquely. Some are on the transposing plan. The Belgian pianos have a general resemblance to those of French make.

Austria

exhibits four grand and one upright piano-fortes, by five different makers.

A seven-octave grand, by Hoxa, Vienna, has a peculiarity in that the string-plate consists of separated strips of thin metal, united to one plate at the back, something like a comb,—the front or loose ends of the strips carrying each three or four strings. The object of this is, we presume, to avoid cross strains in the plate, and to throw the whole tension directly on the back end, where it is united to the frame. In other respects all the grands are nearly alike. The framing seems to be on the usual plan, with metallic bars, but the upward bearing is not used. The action is altogether different from the English mechanism; the hammer is reversed in position, having its head turned towards the front of the instrument, instead of towards the back, as with us. The movement from the key is given therefore to the back end of the hammer. The check is a fixture in front of the hammer-head, and the escapement has a singular action, which throws the hammer forward against the check at the time it falls. There appears to be no contrivance for repetition. The dampers for the lower half of the instrument consist of wedges of soft cloth, entering between the strings, instead of flat surfaces simply dropping upon them.

M. Seuffert, Vienna, exhibits an upright in a very handsome case, with three vertical strings to each note. The dampers are placed behind the strings, *i.e.*, between them and the sound-board; an arrangement which gives the power of damping below the striking point, whereby the vibration is more effectually stopped; the bass dampers are on the wedge principle. The action is peculiar.

Germany

(the Zollverein, &c.,) sends an assortment of instruments of all shapes. Some of the grands are copies of those of Erard.

M. Bessalié, Breslau, exhibits a grand, with a new method

of tuning: the end of each string is looped to an iron screw, which projects through a hole in a fixed plate, running across the whole width of the instrument over the wrest-plank; the screw is tightened up by a nut bearing against the front of this fixed plate, and turned by a key. The plan is something like Lewis's (*vide* Erard), but simpler, and it also simplifies the bracing. There is a difficulty in preventing the screw from turning with the nut, which is overcome in this specimen in rather a clumsy manner. The instrument has an action something like Collard's, and the Austrian wedge damper.

A square by Dörner, Stuttgart, has a new kind of damper, consisting of a lever, placed horizontally over the strings and parallel to the keys. The fulcrum is in front; the back end of the lever is lifted by a wire rising between the strings behind the bridge; and the damping-cloth is fixed on the middle of the lever, between the back end and the fulcrum. The advantages of this damper are analogous to those of Collard's long-headed one, viz., placing the rising wire out of reach of the vibrating string, and bringing the damping point as far along the string as possible. This instrument has three strings to the upper notes.

A square, by Heitemeyer, Münster, is on a new construction: it has an action like the Austrian, giving the blow at the front of the instrument, instead of at the back. The strings are crossed, and the upper half has three wires to a note. There are a number of strings at the back of the instrument tuned to a unison, but not intended to be played upon by the keys; the object of this addition we could not learn.

A cottage upright, by Rühms, Altona, has a framing of cast-iron, with a sound-board on each side.

Denmark.

A grand and a square, by Hornung, Copenhagen, have the wrest block, longitudinal-stretchers, and string-plate, cast in one piece of iron, on the American plan. The stretchers are not straight bars, but consist of ornamental scroll work. The instruments have the English action. The square has the upward bearing;—a novelty, we believe, in pianos of this form.

Russia.

In two grands, by Lichtenthal, St. Petersburg, the bass strings, to the extent of about 2 octaves, are placed at a higher level than those of the other part, and cross them obliquely,

which gives the opportunity of curving that side of the instrument ordinarily made a straight line. We cannot see, however, that the shape, as exemplified in these pianos, is at all improved thereby; while the construction is much more complicated, and therefore inferior. Moreover, strains acting obliquely in different directions, act irregularly on the framing, render it difficult to brace, and tend to throw the instrument out of tune. The action is on the English plan.

The United States

send one double-grand piano, one ordinary grand, and several squares.

A grand, by Chickering, Boston, possesses a novelty, in that the whole framing, consisting of string-plate, longitudinal bars, wrest-block, and drilled bridge (for upward bearing) is of cast-iron, cast in one piece. The plan is a bold one, and deserves attention on account of its cheapness, its strength, and the unity it gives to the system of framing. The ordinary English action is applied. In this and all the other American instruments, the strings for the lower notes are all lapped with iron or soft steel, no copper-lapped wire being used.

A grand square, by the same maker, also has the framing made in one piece of cast-iron. Attached to this, and all the other American squares, is the *jeu céleste* soft pedal, interposing cloth between the hammers and the strings.

Messrs. Nunns and Clark, New York, send a grand square, with what is called an "eolian attachment," *i.e.*, an addition of a seraphine or eolian, which can be played upon with the piano, by the same keys. The mechanism of this is concealed in the under framing of the instrument. The bass strings of this piano cross the others obliquely at a higher level, whereby a greater length is obtained.

Mr. Pirsson, New York, has a double-grand piano, which may be described as consisting of two grands, enclosed in one large oblong rectangular case,—the players sitting at the two opposite ends, facing each other. One string-plate serves for both instruments, the short strings of one coming in a line with the long ones of the other. There is also a new contrivance for tuning, called the "patent wheel tuning pin." It is an application to the piano-forte of the plan of tuning adopted in the double bass and the guitar, the string being attached to a toothed wheel moved by an endless screw. There is, however, an ingenious variation, which much simplifies the arrangement. In the guitar and double bass the string is

wound round the axle of the wheel; but, as there would not be room for this in the piano-forte, where the strings lie closely side by side, a small groove is cut round the circumference of the wheel, in the middle of the teeth; the wire is fixed round this groove, and thus no extension is required on either side of the wheel. This is the most complete and perfect substitute for the tuning-pins that we have seen, although probably the most expensive. The wrest-plate of this instrument is of iron.

THE ORGAN.

THE ORGAN is allowed, on all hands, to hold the first rank among musical instruments. A glance at a few of its qualities will shew that it has just claims to this pre-eminence.

In the first place, it is ennobled by the object to which it is devoted: it is the only instrument consecrated exclusively to the service of religion. Attempts have indeed occasionally been made to employ it for secular purposes, but these have generally failed; and it has always reverted to the use for which it is so eminently fitted by the solemnity and grandeur of its tones.

Secondly. It is the largest and most powerful of all musical instruments. An organ will supply the place of a full orchestra, and will support the voices of the largest chorus that can be brought together.

Thirdly. It requires the greatest amount of skill and labor in its construction, and is by far the most costly. No other musical instrument reaches the value of hundreds of pounds; a large organ is worth thousands.

Fourthly. The compass of tones in an organ is far beyond that of any other instrument, or indeed of all other instruments put together. It comprehends both extremes of the scale through which vibrations become audible as musical sounds.*

Fifthly. The organ is the most comprehensive of all instruments. The variety of tone producible from it far exceeds that which can be obtained from any other. Its loudest peals will shake the edifice in which it stands; while its softest breathings are scarcely more audible than the gentlest zephyr of a summer's eve. And between these extremes may be commanded almost every conceivable quality and combination of tone. The shrill clangour of the trumpet, the pastoral cadences of the oboe, and the smooth warblings of the flageolet,—

* The lowest tone audible is generally considered to be that produced by about 32 vibrations per second (32-feet C); the highest by about 16384 (5 octaves above middle or 2-feet C), giving a range of 9 octaves. The pipes in a large organ will reach or approach both these limits.

as well as many varieties of sound which no other instrument will produce,—all come within the power of the organ.

The organ is a very ancient instrument. The word was originally applied as a general name to all instruments used to accompany the human voice;* but its use gradually became restricted to the one to which it now refers. The term occurs three times in our version of the Old Testament, viz., in Genesis iv., 21, in Job xxx., 31, and in Psalm cl., 4. The Hebrew word, in each case, is עוּגָב ; and the general opinion of commentators appears to be, that the instrument alluded to was something like the syrinx or pipe of Pan, composed of several reeds joined together;† we fear we must submit to the conclusion, that this and the bagpipe are the humble ancestors of the stately instrument with which we are now familiar. The *hydraulic organ,* said to have been the invention of Ctesibus of Alexandria, about 120 B. C., was extensively used by the Greeks and Romans, who employed it as well privately as in their theatres and temples. The exact nature and construction of this instrument are unknown; but there is every reason to believe that it corresponded with our present idea of an organ in many essential particulars. Organs were early introduced into Christian churches. In 757 the Emperor Constantine V. sent one to King Pepin, which was placed in the church of St. Cornelius at Compiègne. In 812 Louis-le-Débonnaire fixed one in the church of Aix-la-Chapelle, and one is mentioned as existing in the church of Westminster (the original of the Abbey), in the 10th century. At Winchester also there was an organ erected in 951, which is cited as possessing four hundred pipes, forty keys, and twenty-six bellows; the keys were very large and were struck by the fist, and two performers were required to play it. Many others are known to have been introduced about this time, and their manufacture soon began to extend. In the 12th century date the improvement of the key-board, the enclosure of several organs in one case, the use of compound stops, and the introduction of pedals, which opened a new era in the history of the instrument. A gradual course of improvement is traced in organs erected at Dijon, in the 13th century, at

* Organa dicuntur omnia instrumenta musicorum. Non solum istud organum dicitur quod est grande, et *inflatur follibus*, sed etiam quidquid aptatur ad cantilenam et corporeum est. Quo instrumento utitur qui cantat, organum dicitur.—*St. Augustin.*

† The Septuagint render the word differently in each case, viz., in Genesis by κίθαρα, harp;—in Job by ψαλμος, song;—in Psalm cl. by οργανον. The former of these renderings appears to refer to a stringed instrument; but this meaning is at variance with the ordinarily received opinion.

Halberstad, in 1360, and at Nuremberg, in 1468; about which period pipes of the large dimensious of 16 and 32 feet began to be made. The description we have of an organ existing in the church of St. Mary Magdalene, at Breslau, in 1596, proves that, at that date, all the principal stops now employed had come into use, and that the general plan of a large organ, in all its most important particulars, had arrived at the point at which it now stands,—the only further progress made since having been in the mechanical details of the construction.

Description of the Organ. Sound-board, &c.

The tones of an organ are produced by the action of wind in pipes of different kinds and of various sizes;—the wind being supplied by bellows, and admitted to the pipes through valves opened by keys. To explain how this is effected, we must first describe the principal member or piece of construction which the organ contains, called by English builders the *sound-board.** It consists of a table or frame of wood, lying horizontally, and containing a series of closed grooves or channels, equal in number to the number of keys in the clavier, one channel corresponding to each key. The top covering of each channel is pierced with a series of holes, in which the feet of the pipes rest; so that several pipes stand over one channel, and, accordingly, answer to one note. Towards one end of every channel, on the lower side, is a long slit or opening, communicating with a box, common to all, called the *wind-chest,* into which the compressed air is admitted from the bellows by a *wind-trunk.* This opening is covered by a hinged valve or *pallet,*† capable of being pulled open by machinery communicating with the key. Supposing now any key to be pressed by the finger of the performer, it opens the valve connected to it, and allows the wind to rush from the wind-chest into the corresponding channel of the sound-board, and thence into all the pipes standing over the holes pierced in its upper side. The above description, however, supposes these holes to be constantly open; but this is not so. Each orifice, conveying the wind from the channel in the sound-board to the pipe standing above it, is commanded by a narrow thin strip of wood, called a *slider;* which, having holes pierced in it corresponding to those in the channels,

* A great misnomer, as it has no acoustical properties whatever.

† A misappropriation of the French word *palette,* which refers to another portion of the machinery.

may, by sliding a short distance either way, be made to open or close the communications with the pipes at pleasure. The sliders run at right angles with the channels in the sound-board; and, therefore, supposing the holes in the several channels to be placed in regular lines, it is obvious that one slider will open or close, simultaneously, one hole in every channel, or, in other words, will command a series of pipes, one to each note of the organ. Such a series of pipes, if all of the same character, constitutes what is called a *stop*. The slider is connected by machinery with a rod and knob, projecting horizontally in sight, at the front of the instrument near the keys, and marked conspicuously with some inscription, designating the character of the pipes in the stop it applies to: when this apparatus, called a *draw-stop*, is pulled out, the communication is open, and the pipes of the stop will sound on touching the keys: when it is pushed in, the communication is closed and the pipes are dumb. Large organs have a great number of stops, each with its separate slider and peculiar character of pipe. The slider was invented in the 16th century; previously to its introduction each pipe had a small valve at its foot, and the opening or shutting of a whole row of these together effected what is now so much more simply done by the slider. The ancient plan is still used by Italian organ-builders.

The *bellows* now most generally used in organs are of the double kind, on the same principle as ordinary smiths' bellows, consisting of two parts, the feeder and the reservoir. The feeder, worked by manual labor, acts as a pump, drawing air from the external atmosphere, and forcing it into the reservoir; which, being weighted to a sufficient extent, keeps up a constant supply to the wind-chests of the organ. The pressure of wind ordinarily used, and which is determined by the weight laid on the reservoir, is equivalent to that of a column of water about 3 inches high, or 15 lbs. per square foot. It is customary, sometimes, to have different pressures of wind to different parts of the same organ; and some of the French builders use this plan to a considerable extent. In such cases, of course, separate bellows are required for each pressure. It is only of late that the double bellows have come into use; formerly the apparatus consisted of a series of reservoirs only, which were lifted alternately by the blower, instead of being supplied by feeders. These are still occasionally used on the continent; but the double bellows are much more convenient and efficient machines.

Pipes.

The pipes of an organ are of two classes, producing their sound by entirely different means; these are *flute-pipes** and *reeds*.

Flute-pipes produce their tone on the same acoustical principle as the German flute, the flageolet, or the common whistle; namely, by causing a thin stream of air, issuing from a narrow opening, to impinge upon a sharp-edged blade of some solid material, whereby a column of air contained in a tube is set in vibration, and made to produce musical sounds. Flute-pipes are made either of metal or of wood. The form of a metal pipe, speaking on this principle, must be familiar to everybody who has seen the front of an organ, where rows of such pipes usually decorate the exterior of the case. Three principal parts will be noticed:—the foot, the mouth, and the tube. The foot is of a conical shape, and has no function further than to receive the wind from the hole underneath, and to convey it to the mouth. At the top of the foot, and close underneath the mouth, is fixed a horizontal division or septum, called the "*languid*;"† it extends across the pipe, leaving only a narrow slit open in front, through which a thin sheet of wind rises, in such a direction as to impinge immediately upon the upper lip of the mouth. Part of the wind escapes at the mouth; the remainder enters the cylindrical part or tube of the pipe, above, and vibrating therein gives the tone. Wood pipes are similar in their essential construction to those in metal; but their tubes are square instead of circular in their section, and the foot is differently contrived. Pipes of the flute kind may be either *open* at the top of the tube, or may be *stopped* with a plug, which alters the pitch, as will be hereafter explained. The majority of pipes used in an organ are open and made in metal; the stopped kind are generally of wood.

The pitch of the note spoken by a flute-pipe depends on the length of the pipe above the mouth, and follows the simple geometrical law, that doubling the length makes a pipe speak an octave lower (by doubling the length of the vibrating co-

* By one of the many ridiculous misnomers that have crept into English organ nomenclature, this appellation has been corrupted into "*flue*" pipes. The French call this class *tuyaux-à-bouche*, or *jeux de flûte;* the Germans, *Flötenwerk*. Reed stops are called in French *jeux d'anche;* in German, *Schnarrwerk*.

† Another absurd misnomer, being a corruption of the French word *languette*, which, however, means quite a different thing, the tongue of the reed.

lumn of air),—or, *vice versâ,* halving the length makes it speak an octave higher. It is found, by experiment, that an open pipe, about eight feet long, will speak the C forming the lowest note of the violoncello, or the note produced by about 128 vibrations per second; and hence we have the following scale:—

No. of Vibrations per Second.	Note.	Length of Open Pipe.
2048	C in alt.	$\frac{1}{2}$ foot
1024	The C on the 3rd space in the treble clef	1 "
512	The C called middle C; the note of the C clef	2 feet
256	The C called tenor C; the lowest note of the viola	4 "
128	The lowest note of the violoncello	8 "
64	The lowest C of a grand piano-forte	16 "
32	The C below	32 "

It is useful to bear this scale in mind, as it affords a key to the arrangement and nomenclature of the various stops, as will be hereafter explained. Moreover, it is now very customary to express the notes by the lengths of pipes corresponding to them: for example, the lowest C of a grand piano-forte is often called 16-feet C; middle C is called 2-feet C; and so on.*

* Some explanation is necessary, to prevent misunderstanding, in reference to this scale.

In the first place, the number of vibrations is approximately that of the old church pitch; the modern orchestral pitch is considerably higher.

In the case of a string, the numbers in the table refer to *single* vibrations, not to *complete* or *double* ones. The latter are used by some writers on harmonics, and the difference, if not explained, would create confusion. The former are evidently the most correct, as indicating the number of distinct impulses given to the air, and corresponding with the oscillations of a pendulum.—See Chladni's elaborate work, "Die Akustik," Leipzig, 1830.

The number of vibrations corresponding to any given note is indicated by a very ingenious instrument, invented by Baron Cagniard de la Tour, and called the *sirène.* It may also be calculated as follows:—Stretch a wire (a piano-forte wire, for example) over two rests, and tighten it by a weight till it sounds the given note. Let l represent the length in inches, and w the weight in lbs., of the vibrating part of the wire; also, let T represent the tension, or stretching weight, in lbs., and V the number of *single* vibrations per second. Then,

$$V^2 = 386{\cdot}156 \frac{T}{lw}.$$

The relation between the sound of any note and the corresponding length of pipe is as follows:—Let L represent the length of the tube part of the pipe, above the mouth, in feet, and V the number of vibrations per second corresponding to the given note. Then, approximately,

$$V = \frac{1024}{L}. \text{ or } L = \frac{1024}{V}.$$

The above scale refers to *open* pipes; when they are *stopped* at the top, a remarkable change occurs, the effect being to cause them to speak an octave lower. Thus, a stopped pipe, 8 feet long, will speak the same note as an open one of 16 feet; a stopped pipe, 2 feet long, will speak the note of an open one of 4 feet; and so on. The reason of this is, that, as the air cannot get out at the top of the pipe, it returns, and makes its exit at the mouth; the effect of which is to double the length of the vibrating column, and so to make its vibration proportionately slower.*

The *quality* of the tone of a flute-pipe depends principally on the *scale,* and the *voicing* of the pipe, and sometimes on slight peculiarities in its form or construction. By the scale of a pipe is meant the proportion which the diameter of the tube bears to its length; if the diameter is large, the pipe is said to be of a large scale, and will have a powerful and full tone;—if small, it is a small scale, and the tone will be thinner and softer. The scale of the principal stops of an organ should be, therefore, always adapted to the size of the building it is intended for; while the use of different scales in the same organ gives the means of producing stops of diversified tone. The principal element, however, in producing the quality of tone, is what is called the "*voicing;*" it consists in the careful formation of the mouth of the pipe and parts adjacent, and the regulation of the quantity of wind it shall receive, by opening or closing the hole at the bottom of its conical foot. It is a most delicate operation, requiring the greatest skill on the part of the operator.

Many of the pipes for the lower notes are too large to stand over their proper holes in the sound-board. In this case they are fixed in convenient places, at some distance, and the wind is conveyed to them from the sound-board by tubes. It is customary also to place rows of pipes in front of the case, and these are supplied with wind in like manner. These ranges of front pipes constitute what is called in France the *montre;* and, in Germany, the stop to which they belong is called the *principal.*

The metal principally used for the construction of flute-pipes, on the continent, is tin; in England, it is a cheaper mixture of tin and lead. The former is superior, being more durable, and giving a more brilliant quality of tone. In the continental organs, the pipes visible in front of the case are carefully finished and burnished, and shew the bright natural

* A stop consisting of stopped pipes, is called, in French, a *bourdon;* in German, *gedact*, a corruption of the participle *gedeckt.*

lustre of the white metal; but in England, where the ignoble alloy is incapable of retaining its polish, the pipes are obliged to be gilt or painted to make them appear respectable.

The other great class of organ-pipes are the *reeds*. The sound of these is produced on the same principle as that of the clarionet and the bassoon, namely, by the vibrations of a thin tongue of some elastic material, put in motion by the wind. A reed pipe consists of three parts,—the foot, the reed apparatus, and the tube. The foot receives the wind; it is a sort of box, into the upper part of which is inserted the end of the pipe tube, having the reed apparatus attached. This consists of a small brass tube, having one flat side, in which an oblong slit is made; this slit is covered by a tongue or leaf of thin hard brass, fixed at one end, and left free to vibrate for the remainder of its length. The compressed air surrounds the whole, and tends to press the tongue flat down upon the slit and close it like a valve, which it would do if the tongue were perfectly flat; but it is slightly curved, so as to allow the free end to stand, by the natural spring of the metal, a little off the face of the tube. The wind rushing through the opening thus left, presses the tongue momentarily down, but it is immediately raised again by its elasticity; the quick repetition of this alternate action causes it to beat against the face of the tube in a continual succession of vibrations. Every time that the tongue rises, a portion of wind escapes through the opening, and enters the tube of the pipe fixed above, and communicating with the small tube of the reed; and it is to the vibrations caused by the pulsations of air thus following each other in quick succession, that the sound is ascribed,—the tongue being merely the instrument of producing them. The pitch of the note sounded by a reed-pipe is determined by the length, the thickness, and the elasticity of the brass tongue, and not by the length of the tube.

The tube of the reed-pipe, however, materially affects the quality of the tone. It is imperative that it should be made such a size that the vibrations of the column of air it contains exactly correspond with those given by the reed. When thus arranged it acts in the same manner as a speaking-trumpet does to the voice, rendering the tone more full and powerful. The diameter and form of the tube also influence the quality; and, by variations in these particulars, different varieties of reed-stops are obtained. The tone of reed-stops, in general, is of a sharp cutting character: they add considerably to the brilliancy and power of the organ, and in

their more delicate varieties form agreeable stops for solo or fancy performance. The tubes of the reed-pipes are, in England, formed of the ordinary pipe-metal, lead and tin; but, on the continent, those of the principal stops are made of purer tin. For this reason, and also on account of the greater importance assigned to this department of the organ in French instruments, our neighbours excel us in the brilliancy and effect of their reeds. The tubes of some of the largest reed-pipes are often made of wood, to save expense.

Stops.

Having now described the pipes individually, we proceed to explain how they are used collectively in the form of stops. A stop is a range of pipes, of the same character of tone, extending throughout the compass of the organ, generally one to each note; so that if a certain stop is drawn, the keys will play throughout on pipes of that character of which the stop consists.* Large organs contain a great variety of stops,

* The unmeaning and unsystematic nomenclature of organ stops, which has gradually crept into use, has become the subject of great complaint. The names attached to the stops, instead of serving to guide their use, only tend to perplex the player, and to produce confusion and misunderstanding. Let us take, for example, a few names most commonly adopted in England. The ordinary 8-feet stop is called a "*diapason*," a Greek term, signifying "through all," which, if applied to the stop of an organ, must mean "throughont the whole compass of the instrument;" but this signification is just as applicable to any other stop as to the 8-feet, and the name is therefore useless as a description of the stop in question. Again, the 4-feet open stop is called the "*principal*," whereas it is not a "principal" stop in any sense of the word, but quite a subordinate one. A certain compound stop is called a "*sesquialter*," often metamorphosed into "sexsqualltra," or some other equally droll orthography; the term, as used in English, is a mathematical one, signifying a ratio of one and a half, but in what sense this can be a description of the stop it refers to we leave to the scholarship of makers to explain. "*Furniture*" is another unmeaning name for the same kind of stop, being an absurd translation of the French "fourniture." One would think that where the stops were named after certain instruments, something like consistency might be expected; but a few specimens will shew that even with these have the same errors been committed. A 4-feet soft stop is called a *flute;* but although there are several stops in an organ which *do* represent a flute, this *does not*, inasmuch as it speaks an octave too high. The stops called *trumpet* and *clarion* are essentially different, although the names are synonymous. The *cremona* (probably a corruption of the German *krum-horn*), *cornet*, *bassoon*, and many others, are misnomers; and the only qualification for the name of *vox humana* is, that its pipe must have a double cone at the end. But, as if the errors already existing were not bad enough, we have been lately inundated with a number of new fancy names, either adapted (almost always erroneously) from foreign languages, or invented by makers of new organs, without a shadow of reason or necessity.

The object of the label on the stops should be to guide the player in using them; and, in order to do this, the label should clearly, but simply, describe the stop it applies to. Now we have stated in the text that the

nearly all differing, in some respects, from each other; but we may simplify the description of them by remarking, that the character of every stop depends on two elements, namely, its pitch and its quality of tone.

Stops are of different *pitch, i. e.*, the same key will sound different notes, according as different stops are drawn. There are two modes of designating the pitch of a stop,—the English and the continental mode. The mode which, for the sake of distinction, we call the English (although, in reality, it is but partially adopted in this country), is by stating the interval which any note of the given stop makes with the fundamental note, corresponding to the key struck. Thus, when the key middle C (2-feet C) is struck, a certain stop will sound the G, at an interval of a twelfth above; this stop is therefore called the "twelfth." Another stop will sound the C two octaves above, and is therefore called the "fifteenth." The stops which sound the fundamental note itself would be on this principle designated "unison," and those sounding an octave above it would be called "octave." For the stops sounding an octave below the fundamental note the word "double" has been used, and, though not correct in principle, it may be considered as sanctioned by custom.

To explain how the pitch is designated in continental organs,

character of every organ stop consists of two elements,—1st, its pitch; 2nd, its quality of tone. Here, therefore, we have the foundation for a reasonable rule, viz.,—*the label of an organ stop should express, in the simplest way, its pitch, and its quality of tone.* Very few of the names at present used express either the one or the other, but it would be very easy to indicate both, if builders were content to follow some rational system, founded on common sense and the English language.

With regard to the *pitch*, either the English or the continental method, described in the text, might be adopted, if made consistent and uniform. If the former, the words "diapason," "principal," "quint," "decima," &c., should be discarded, and replaced by the more intelligible English terms "unison," "octave," "fifth," "tenth," and so on. The continental method has the inconvenience of occasionally requiring the use of fractions, but it is universally adopted by all nations except ourselves.

The *quality of tone* of a stop should be described by some simple and intelligible name, which might have reference either to the character of the sound, or to the construction of the pipe producing it. For the ordinary quality of open metal flute pipe, of which the bulk of the stops consist, the word "*open*" would suffice. All reed stops should be marked "*reed*," and some qualifying term might be added when the tone was peculiar, as "clarionet reed," &c. In case of absolute necessity, coined or foreign names for peculiar varieties of tone might be tolerated, but they should be definite and consistent, and not introduced, as they now are, for the sake of pedantic display.

Compound stops, used in the full organ, require no definition either of their pitch or quality of tone. The word "compound," with a statement of the number of ranks, would express all needed in regard to these. The ordinary names "sesquialter," "mixture," "cornet," &c., convey no suitable idea, and ought to be abolished.

we must premise that the lowest note of the organ manual claviers is always supposed to be, and in well designed large organs always is, the note C corresponding with the lowest note of the violoncello. This being understood, the pitch of a stop is expressed by defining the note which that particular stop speaks to the lowest key of the organ manual; and the way adopted of defining this note is by giving its corresponding length of pipe (supposing it to be of the open flute kind), according to the table in page 48. A few examples will make this clear. The stop mis-called "diapason" by English organ-builders, and which speaks 8-feet C to the lowest note of the manual, is called an 8-feet stop, as are all those that speak in unison with it. Stops of this pitch are the most important in the instrument, as they give the same sound as that represented by the key struck. Stops which speak an octave lower than these, giving 16-feet C to the lowest note, are called 16-feet stops. Those speaking an octave higher, giving 4-feet C to the lowest note, are called 4-feet stops, and so on.*

The tone of every key in a large organ consists of notes of many different pitches combined, so as to blend together, and to give the effect of one sound. The first organs consisted of the fundamental note only, or what would now be called the 8-feet or unison stop; and, doubtless, the first attempts to increase the power were by sounding several of these together; but it must soon have been discovered that the accumulation of sounds of the same kind, vibrating in unison, did not produce any thing like a corresponding increase of effect; and therefore it became necessary to resort to some other expedient for attaining the wished for end. The addition of a pipe sounding the octave above, or a 4-feet stop, was probably the first effort in this direction, and was followed by the further addition of the fifteenth (2-feet), by which a powerful and brilliant effect was gained. At length it appears to have been remarked, that in certain sounds, of which that of a bell is a good example, other notes were heard beside the fundamental one, forming what are called harmonic intervals with it; and yet the whole combining into one powerful

* The foreign mode of designating the pitch of a stop has been much misunderstood and misapplied in England. For example, 8-feet or unison stops have been called 4-feet when they consisted of *stopped* pipes, because their longest pipe was only that length,—the makers losing sight of the principle that the designation applies to the *note sounded*, and not to the actual length of pipe producing it. Again, when the organ manual extended a few notes lower than the orthodox limit, an 8-feet stop has been called a 10 or 12-feet; or, if an octave lower, a 16-feet. Other mistakes, equally at variance with the principle, have been made.

single tone. This suggested a means of further increasing the power of the organ; and, accordingly, a pipe, speaking the *twelfth* of the fundamental note (a $2\frac{2}{3}$-feet stop), was added, which gave additional power and mellowness to the tone. This combination of four stops, viz., the fundamental note (8 feet), its octave (4 feet), its twelfth ($2\frac{2}{3}$ feet), and fifteenth (2 feet), forms a tolerable organ, and is often used when only a moderate degree of power is required. Further extensions of the principle were, however, found to be necessary for large buildings, and then arose the "compound" stops, consisting of various combinations of the intervals of the major common chord, or 3rd, 5th, and 8th, in octaves above the fifteenth, giving a peculiar brilliancy to the whole combined sound. Here, however, arose a difficulty;—in proportion as the compound stops or "mixtures" were increased, and carried higher in the scale, it was found that the whole sound had a tendency to become too shrill, and wanted weight at the bottom; and since, for reasons already explained, it was of little use to augment the number of pipes speaking the fundamental note, the plan was felicitously hit upon of adding the octave below, called the "double" or 16-feet stop. This last addition has been the salvation of large organs; without it a tone, at once brilliant and powerful, and suited for large edifices, could not have been obtained. It not only added, in the most effective manner, the weight necessary to balance a bright combination of mixtures, but has allowed of several intervals being inserted which could not otherwise have been used; viz., the fifth ($5\frac{1}{3}$ feet) and tenth ($3\frac{1}{5}$ feet) of the fundamental note. One or two bold makers have added the interval of the flat seventh, which exists in nature, and may, with great caution, be made to combine with the sound. In some of the largest French organs, and in one English one (St. Olave's, Southwark, designed by Dr. Gauntlett), a 32-feet stop, speaking two octaves below the fundamental note, has been used. The small compound stops are generally so arranged that one draw-stop serves for several ranges of pipes, and hence a compound stop is said to consist of 2, 3, 4, 5, or 7, ranks, as the case may be.

An idea may now be formed of how the tone, in a large organ, is produced. On touching any key it sounds not only the note proper to it, but also several octaves of it, above and below; and, in addition to these, several repetitions of the harmonic intervals forming its common chord. Yet, when these sounds are correctly balanced and adjusted to each other, the entire effect is but that of one note, the fundamental one,

endowed, however, with a body and a brilliancy that could be obtained by no other means. We need scarcely add, that the adjustment of the stops to each other, is one of those operations in which an organ-builder's knowledge, experience, and skill are most required.

The "reeds" form a considerable reinforcement to the power of the full organ. They are used in the form of 16 feet (double), 8 feet (unison), 4 feet (octave), and sometimes 2 feet (fifteenth) stops. The former of these, though very common in organs of moderate size abroad, and one of the most effective in adding power and weight to the tone, has been hitherto but little used in this country.

Besides the above-mentioned stops, which compose what is called the "full organ," there are many others of peculiar quality of tone, called "solo" or "fancy" stops. They are generally either 8 feet or 4 feet in pitch, but principally the former; and they are made both of the flute and the reed kind. The variety is given in the flute stops by the scale, the material or the form of the pipe, and by the voicing. Wood pipes, whether open or stopped, produce a more subdued tone than metal; and this may be much modified by alterations in the mouth and different modes of voicing. A favorite kind of flute solo stop is made by so voicing an open wood pipe as to give a soft reedy quality of tone. A stopped metal pipe, with a hole through the stopper, prolonged by a small tube above, and called by the French *flûte à cheminée*, gives a clear mellow tone. The delicate silvery sound of the stop called the "dulceana," is produced by an open metal pipe, of very small scale; and an agreeable kind of tone has been lately obtained by a pipe pierced with a hole in its side. A fine stop, used by the French, is produced by making the pipes "overblow," as it is called, so as to sound an octave higher than the note due to their length.

Among the reeds, varieties in quality are produced principally by varying the form of the tube. The ordinary tube is conical; that of the stop called the oboe has a bell mouth; and a parallel tube gives a tone much resembling a clarionet. The so-called *vox humana* is usually a variety of reed-stop.*

* The *vox humana* stop has been a favorite theme for sentimental tourists and book-makers, who, ignorant enough of the subject, have undertaken to eulogize foreign organs, and absurd stories have been promulgated about its being mistaken for a choir, &c. All this is pure imagination. The stop bearing this name is, in most cases, little or nothing like what it professes to represent, but a disagreeable nasal snarl, of which any street ballad singer would be ashamed. It is much less like the tone of the human voice than a good open flute pipe of the ordinary quality. The English *vox*

The continental organ builders, particularly the Italians, are greatly in advance of the English in the number, variety, and beauty of their solo stops; indeed it is only within these last few years that any attention has been paid to them in this country.

General Arrangement.

In a large organ, containing a great variety of stops, it is found advisable, for the convenience of the performer, not to make the whole of these playable by one key-board, but to distribute them upon several. The instrument then consists of two, three, or more organs, entirely distinct and separate, each having its own sound-board, stops, and clavier,—the claviers being placed one over the other, conveniently for the performer to play on which he pleases. In addition to these, there is also a separate organ, with a key-board to be played upon by the feet, and called the "pedal organ." The arrangement and number of these organs varies in different countries, and in different sized instruments. No organ of any pretensions should have less than two claviers; and all large ones have three, exclusive of the pedals. We shall take an organ of this class for description.

The most important of the three manuals is called the "great organ;" it contains the principal stops for giving power; and its keyboard is generally the lowest but one. The compass is, 4 octaves in old and $4\frac{1}{2}$ octaves in modern organs, beginning with C (8 feet) as the lowest note. In France, the principal reed-stops, and some other powerful stops, are made into a separate organ, receiving a different pressure of wind. Its clavier, called the *clavier de bombarde,* is immediately above that of the *grande orgue,* and is capable of being coupled with it, that they may be played together.

The lowest row of keys generally belongs to an organ of smaller size, called on the continent the *positif,* and in England the "choir organ." It is often placed in a separate case in front of the larger one, and contains stops of a light character, and solo-stops. Its compass is the same as that of the great organ.

The organ to which the upper clavier belongs, is called in

humana is a reed with a double cone at the top of the pipe;—the French *voix humaine* has a cylindrical tube, partly closed at the top. The Italian *voce umana* is of a different kind altogether, being composed of two *flute* pipes of a thin quality, one tuned a little flatter than the other, so as to give a tremulous tone like that produced by a good singer, or a skilful player on the violin. This latter kind of stop has also been called *voix céleste* and *unda maris*; its effect is agreeable when judiciously made.

England the "swell," and consists of an organ shut up in a box closed on three sides, but furnished in front with Venetian shutters, or moveable louvre boards, made to open and close by means of a pedal. When they are shut, the sound of the enclosed organ is muffled and distant; but, on putting down the pedal, they are gradually opened, and the sound becomes louder. The swell thus gives what the instrument would not otherwise possess, viz., the power of *crescendo* and *diminuendo*; and, when this organ is large, the effects producible are exceedingly fine. The swell is an English invention; but by whom or when introduced, we cannot learn. It is not much used abroad. The swell contains the same kind of stops as the great organ, but usually on a smaller scale. The compass in large organs is the same as the other claviers; but stopped pipes are used for the lower notes, in order to save room.

The pedal organ is played by the feet,—the keys being of a convenient size for the purpose.* The compass is usually $2\frac{1}{4}$ or $2\frac{1}{2}$ octaves, beginning with C as the lowest note. The stops are 32-feet stops, of the flute kind, in metal or wood, or both, with 16-feet, 8-feet, and smaller sizes, as in the great organ; also 32-feet, 16-feet, 8-feet, and 4-feet reeds. In organs of small size, the 32-feet stops are not found. In England, few organs have any large separate pedal organ; but the pedals are made to pull down the keys of the great organ, having, in addition, one or two sets of 16-feet pipes, called "pedal pipes." The large organ at St. Paul's, Frankfort, has two separate pedal claviers, each playing distinct pedal organs.

Mechanical contrivances.

The organ contains some mechanical contrivances, which add considerably to its effectiveness, and which it is necessary therefore to explain.

Among the foremost of these rank what are called *couplers*, *i. e.*, movements, by the aid of which, different sets of keys may be made to act on each other, or be coupled together,—the object being to give additional power and variety. A large organ has generally couplers by which the great organ may be made to play all the others, so as to put the power of the entire organ together; or the claviers may be otherwise

* Great inconvenience arises from different dimensions of the pedal clavier being adopted by different makers. We heard a celebrated German organ player and writer, while playing lately on some of the organs in the Exhibition, express himself strongly both on this point and on that of the nomenclature of the stops. It is a stigma upon organ building, that an organist, no matter how eminent or well practised he may be, must study every new organ he comes to, before he is able to manage it.

united together in pairs, by which increased variety in the mixture of stops is attained. Another kind of coupler is that which causes any key to pull down its octave above or below, by which great increase of effect is obtained; these are more common in foreign than in English organs, and in Italy this kind of mechanism is called the *terza mano,* or third hand. The couplers are made to act by draw-stops, projecting at the front of the instrument, or sometimes by pedals. The latter plan is generally adopted in France.

Another mechanical contrivance is that of pedals for opening and shutting the stops. It became obvious, at an early period, that it would be convenient to effect, while playing, certain changes in the disposition of the stops, without using the hands for that purpose; and the first contrivance of this nature was a pedal, to take off the loud stops only. This was called the "shifting movement," but its use was very limited, and it was superseded by the present arrangement of "composition pedals." There are a series of pedals, to each of which corresponds a certain given combination or "composition" of stops, and which, on being pressed down, will ensure this combination of stops being drawn, no matter what was drawn before; it will push in those stops that do not belong to its own combination, and will pull out those that do; thus, a certain pedal will always give the full organ, a certain other one the 8-feet stops only, and so on. The composition pedals were invented by Mr. Bishop, the English organ builder, in 1809, and are now very generally used. Some of the organs in the Exhibition have new contrivances for acting on the stops, which will be noticed in the proper place.

Mr. Bishop has also contrived a means, which he terms an "anti-concussion apparatus," for remedying the pulsation or concussion of air in the wind-chest, when a large number of pipes suddenly cease speaking, and but a few are held on. It consists of a small reservoir, communicating with the wind-trunk, and pressed down by a spring, so adjusted as to balance exactly the ordinary pressure of wind. When, therefore, the main reservoir is suddenly stopped, and a momentary extra-compression of the air is thereby caused, the anti-concussion spring gives way, and the pulsation of wind lifts the small reservoir, instead of expending its force on the pipes that are speaking. This apparatus was applied to the organ in St. Paul's Cathedral, in 1828.

The ingenuity of organ-builders has been exercised also in contrivances for lightening the touch. In large organs, the valves or pallets, for admitting the wind to the channels in the sound-board, require to be of large size, particularly for

the lower notes, and the pressure of wind upon them is therefore very considerable. This pressure having to be overcome by the fingers, whenever the valve is opened, one of two evils must ensue; either the touch must be very heavy, or a limit must be put to the size of the valve and the pressure of wind used. The first alternative renders the organ difficult to play; the second is unfavorable to its perfection, and forms a bar to all improvements in which a greater force or quantity of wind is required. Several attempts have been made to remedy this; and the Exhibition affords examples of some successful contrivances directed to this end, the peculiarities of which will be hereafter described.

Some foreign organs have an apparatus called the *tremblant* or *tremolo,* for producing a trembling or shaking effect in the sound; but its use scarcely appears legitimate, and it is almost discarded. The effect is produced by a valve being placed in the wind-trunk, in such a manner as to communicate vibration or pulsation to the wind as it passes along.

Remarks on English Organs.

The continental nations have, until very lately, been in advance of the English in regard to their large organs. It is true that, in the mere mechanical construction and workmanship, our builders have generally excelled; but the principles of design used here have been imperfect, and until the re-adoption, within the last few years, of the continental models, England can scarcely be said to have possessed a large organ worthy of comparison with the magnificent instruments of Germany, of Holland, or of France.

When we consider that so long ago as the end of the sixteenth century the organ had arrived, as regards all essential features of its design, at its present state of perfection, it seems strange that England—a country not usually backward in works of scientific construction—should have fallen so much behind the rest of Europe in this particular. We have no excuse in the nature of our forms of religious worship; for Holland and great part of Germany bear witness that Protestantism by no means tends to discourage the use or the improvement of the organ: we believe that the cause of the evil is to be found in the general indifference (peculiar to this country) manifested in regard to the musical portion of our religious services. It would be out of our province here to trace this historically; we must content ourselves with briefly noticing the principal points in which the plan of construction adopted in England, down to a late period, has differed from the foreign model, now rapidly taking its place. These are

three, all of vital importance to the constitution of a large instrument.

In the first place, all the stops speaking below the unison or fundamental note have been omitted. We believe that twenty or thirty years ago there was not an organ in England that possessed a 16-feet stop on the manual clavier. This necessitated also a reduction of the compound and harmonic stops, and the consequence was that the instrument lost its weight of tone, and the most effective means of giving it power. But it brought a still worse evil, as regards the style of playing; indeed, in this, as in many other instances, the deterioration in the instrument itself, and in the manner of using it, have been intimately connected. A great but universal fault in English organ performers has been the abandonment of the original method of playing in *distinct parts* (so beautifully exemplified by the German organ writers and players), and the substitution of a vicious manner of putting down as many notes as possible by full chords in each hand, to the utter destruction of clearness in the composition, and the total loss of what has always been one of the distinguishing features of good organ music, viz., *counterpoint*. That full chords may occasionally be employed for certain effects, is shewn by many of the works of Bach and other great organ composers; but this method of playing, as a system, is exceedingly objectionable, and has, we believe, done much to check the cultivation of the higher style of musical composition. Yet the full style of playing becomes almost indispensable on the English organ. The absence of the 16-feet stops makes playing in parts sound thin and meagre, and the organist is thus obliged to provide against the defects of his instrument, by introducing compensating defects in his performance. On the other hand, the better construction of organ does not admit of the bad style of playing; for, if full chords are persevered in where 16-feet stops exist, the effect becomes confused and disagreeable.

Secondly. The pedal organ has been almost entirely abandoned. Until very lately, in the vast majority of cases, even no pedal clavier has existed;* and where a few keys have been added, they have seldom done anything more than pull down the bass notes of the manual clavier. One stop of eight or a dozen "pedal pipes" has been considered a bold improvement. Hence, another great defect in English organ playing has been the absolute ignorance of the use of the pedals. In

* A curious tradition is extant of an organist of the last century, who produced what was considered by his hearers an almost magical effect, by placing a piece of lead on a bass note to form a "pedal point."

the few cases where organs had these appendages, the organists either carefully avoided them, or used them only now and then to hold a "pedal point;" occasionally, perhaps, some bold player would employ them to double the bass notes in easy passages, but the idea of their playing a separate part of the composition, entirely distinct from the hands, does not seem to have entered into the mind of any one. Whether the abandonment of the pedal organ was the cause of the disuse of pedal playing, or *vice versâ*, we have now no means of knowing. Probably they both went on together. The absence of the pedal organ, combined with the want of 16-feet stops, has led to the extension of the manuals downwards below the orthodox C. In the first place, the key C sharp was made to speak A, and another key, B, was added, speaking G; this ridiculous arrangement was called the "short octave;" but the compass was subsequently extended to G entirely, and called the "long octave." This was the usual extent of English organs until the re-adoption of the foreign plan.

Thirdly. The English organs have had little or no variety in the quality of tone of their stops. Only one or two solo stops have been known; and these have been but little used.

It is a remarkable proof of the deterioration of the organ in the last century, that Handel, who was Bach's contemporary, but whose career, as a composer, was entirely English, wrote no organ music, properly so called. All his clavier compositions do equally well for the harpsichord or the pianoforte. We know of no evidence that he either wrote for or used the pedal clavier.

Happily, however, the time has now arrived when both organ-builders and organ-players, in England, are beginning to follow the more perfect methods of their continental neighbours. The origin of the improvement may, we believe, be traced to the introduction to the English public, some quarter of a century ago, of the immortal organ works of John Sebastian Bach. It was soon perceived from them, that not only were our players ignorant of the true organ style, but that the true organ music could not be played upon our organs. This led to the examination of foreign instruments, and to a gradual adoption of their principles of construction; which may now be said to be fast becoming general. The result is a marvellous improvement in organ-playing; for whereas the compositions alluded to were sealed books to the organists of the last generation, they now form the ordinary practice of every accomplished organ performer.

The following table exhibits a comparative view of the contents and composition of several of the largest organs in the world:—

COMPARATIVE TABLE OF THE COMPOSITION OF SEVERAL LARGE ORGANS.

	FRANCE.			GERMANY AND HOLLAND.				ENGLAND. *(Old Plan.)*			ENGLAND. *(Modern Plan.)*			
	St. Denis.	Madeleine.	St. Sulpice.	St. Michael's, Hamburg.	St. Paul, Frankfort.	Weingarten, Suabia.	Haarlem.	York Minster.	St. Paul's Cathedral.	Canterbury Cathedral.	Birmingham Town Hall.	Ashton-under-Lyne.	St. Peter Radley, Oxford.	Willis. (Exhibition.)
GREAT ORGAN.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Flute Stops Dble. dble. 32 feet	1	3	1	...	1	...	...	...	...	...	...	...	...	...
Double 16 „	3	7	3	2	3	2	2	...	...	...	1	1	1	2
Unison 8 „	6	...	5	4	3	7	3	6	3	3	4	3	3	3
Fifth $5\frac{1}{3}$ „	...	2	...	1	1	...	1	...	...	...	1	1	1	...
Octave 4 „	3	...	1	2	2	4	2	10	1	1	2	2	2	3
Tenth $3\frac{1}{5}$ „	...	1	...	...	1	...	...	...	...	...	...	1	1	...
Twelfth $2\frac{2}{3}$ „	2	2	1	1	1	1	1	2	1	1	1	1	1	1
Fifteenth 2 „	2	10	1	1	1	1	1	6	2	1	2	1	2	3
Others	27	1	26	19	18	45	12	36	8	7	14	7	7	10
Reed Stops Double 16 „	1	4	1	1	1	...	1	...	...	...	1	1	1	1
Unison 8 „	5	1	4	1	2	1	2	5	2	2	1	1	1	1
Octave 4 „	3	...	3	...	1	...	1	3	1	1	1	1	1	1
Fifteenth 2 „	...	...	...	...	...	...	...	...	...	...	1	1	...	1
CHOIR or POSITIF.														
Double 16 feet	1	...	1	1	1	0	1	...	...	...	...	...	...	1
Unison 8 „	6	6	9	5	7	5	5	5	5	3	4	4	4	6
Octave 4 „	4	3	3	2	3	4	2	3	1	3	·4	3	2	5
Others	11	1	16	13	8	17	16	10	2	...	1	1	1	2
SWELL or UPPER CLAVIER.														
Flute Stops Double 16 feet	...	...	1	1	1	1	1	...	...	1	1	1	1	2
Unison 8 „	3	3	3	3	4	4	3	5	2	2	2	3	3	5
Octave 4 „	2	...	1	2	4	1	2	4	1	1	1	2	2	3
Fifteenth 2 „	...	1	...	...	1	2	1	1	1	1	1	2	1	2
Others	2	...	5	15	1	16	14	11	2	4	3	11	8	13
Reed Stops Unison 8 „	2	4	3	2	3	1	3	4	3	3	4	3	2	4
Octave 4 „	1	...	...	...	...	...	...	...	...	...	1	1	...	1
Total pipes to each note ...	85	49	88	76	68	112	74	111	35	34	51	52	45	70
PEDAL ORGAN.														
Flute Stops 32 feet	...	1	1	2	2	2	1	3	...	...	2	...	...	1
16 „	3	2	2	3	5	3	2	3	1	2	4	2	2	4
8 „	1	2	2	1	4	4	2	...	...	...	1	1	1	2
4 „	1	...	1	1	2	2	1	...	...	...	1	1	1	1
Others	1	...	...	12	5	18	5	...	...	...	9	6	6	7
Reed Stops 32 feet	...	...	1	1	...	1	1	1	...	...	1	...	...	...
16 „	1	1	2	1	2	1	1	1	...	...	1	1	1	1
8 „	3	1	2	1	1	1	1	...	...	...	1	...	1	1
4 „	2	1	1	1	1	...	1	...	...	...	1	...	...	1
Total pipes to each pedal ...	12	8	12	23	22	32	15	8	1	2	21	11	12	18
Total pipes in the organ ...	4506	...	...	...	...	6666	5000	8000	...	...	4000	...	2833	4500

REMARKS.

(1) Built by M. Cavaillé, in 1841.

(2) Built by the same maker, in 1846. These two organs contain several stops entirely new, and unknown in this country.

(3) Altered and enlarged by Mr. Barker, in 1846. The cost of this organ, from first to last, has been 146,450 francs, or nearly £6000.

(4) Built by Hildebrand, in 1762, at a cost of £4000.

(5) Built by Walcker, of Louisbourg, in 1833, at a cost of 30,000 florins, or about £2500.

(6) Built by Gabler, of Ravensburg, in 1750. This organ is peculiar in having so many compound stops and so few reeds.

(7) Built by Christian Muller, in 1738. This organ is much more lauded than it deserves to be. It is a tolerably large organ, on the German plan, of average quality; nothing more.

(8) Built by Elliot & Hill, of London, at a cost of £5000. It is of immense size, but unfortunately is laid out on an imperfect plan, which renders it a much less effective instrument than many of half its pretensions. It will be noticed that there is not a single 16-feet stop on any of the manual claviers.

(9) Built by Schmidt, in 1697, and lately enlarged by Bishop.

(10) An old organ, enlarged by Hill. This and the two former are inserted here to shew the peculiarities of the old English plan of building large organs.

(11) This organ was built by Hill, in 1834; but, in defiance of his remonstrances, was laid out in such an absurdly erroneous manner, that it proved a total failure. It was afterwards entirely re-modelled.

(12) Built by Hill.

(13) Built by Messrs. Telford, of Dublin.

(14) More fully described in the present article.

Organs in the Exhibition.

The Industrial Exhibition of 1851 contains fourteen organs, eleven English, one from France, one from Germany, and one from Florence. Of these, three English, one French, and one German, are large organs, of a scale suitable to a church or other large building; the others are small or chamber organs.

English Organs.

Messrs. Hill & Co. exhibit a small but effective organ, of 16 stops, and containing several novelties. It has two rows of keys, and the contents are as follows:—

Great Organ (lower clavier).

1.	Double diapason	Open 16 feet.
2.	Open diapason	Open 8 feet.
3.	Stopped diapason	Stopped 8 feet.
4.	Octave	Open 4 feet.
5.	Twelfth	Open $2\frac{2}{3}$ feet.
6.	Fifteenth	Open 2 feet
7.	Sesquialter	Compound 3 ranks.
8.	Cornopean	Reed 8 feet.
9.	Krum-horn	Solo reed 8 feet.
10.	Wald-flute	Open wood 4 feet.

Swell Organ (upper clavier).

1.	Claribel	Open wood 8 feet.
2.	Gems-horn	Open 8 feet.
3.	Hohl-flute	Open 8 feet.
4	Hautboy	Soft reed 8 feet.
5.	Tuba mirabilis	Loud reed 8 feet.

Pedal Clavier.

1.	Double diapason	Open wood 16 feet.

The compass of both the manual claviers is $4\frac{1}{2}$ octaves, from C to F; that of the pedals is $2\frac{1}{4}$ octaves, from C to E.

The stop called *cornopean*, in the great organ, is a reed giving a round full tone; the *krum-horn* has a cylindrical pipe, and the tone is of a thinner and softer quality; the *wald-flute* is an open wood solo stop, voiced in a peculiar manner.

In the swell, the *claribel* is an open wood stop, now often substituted in the treble for the stopped diapason, as giving a better quality of tone, and being more useful for solo playing. The *gems-horn* is an open metal pipe, with a tube tapering upwards above the mouth in the form of a frustrum of a cone: this stop is taken from the Germans. The *hohl-flute** is an open metal pipe, giving a clear reedy tone.

The *tuba mirabilis* is a new kind of reed stop, invented by

* Such terms as "claribel," "wald-flute," "hohl-flute," &c., are hybrid words, half taken from one language and half from another. "Krum-horn" (crooked horn), "gems-horn" (chamois-horn), and "tuba mirabilis," convey no meaning descriptive of the stops they are applied to. This absurd polyglot system of nomenclature is altogether unnecessary, and therefore objectionable.

Mr. Hill, and first introduced by him into the organ in the Town Hall, Birmingham. It is on a large scale, and blown by a very high pressure of wind, equal to that of a column of water about 11 inches high. It gives a fine round tone, and is of itself nearly equal in power to all the rest of the organ put together.

There are four composition pedals to change the stops in the great organ;—the first brings on Nos. 1, 2, and 3; the second, Nos. 1, 2, 3, 4, and 6; the third, Nos. 1 to 7; and the fourth the full organ. There are also couplers to unite the two claviers, and to cause the pedal-keys to act on either the great organ or the swell.

The stops are not worked by draw-stops, on the customary plan, but by keys, something like those of the manual claviers, placed on each side, within reach of the performer's hands. One row of these keys serves to open the several stops, and another to shut them. As, however, the mere pushing down of a key with the finger would not, of itself, give power or motion enough to move the slider,—the aid of an intermediate apparatus, on the principle of the "pneumatic lever" (see description of the French organ), is called in. The pressing down of the key admits, by a small valve, compressed air into a bellows, the motion of which is communicated to the slider.

In the bass half of the instrument, Mr. Hill has adopted a new kind of valve or pallet, with the object of lightening the touch. It is on the principle of what is called the *double-beat* valve, used in steam-engines.* The valve hangs vertically, and shuts upon two vertical faces; and it is only the pressure of wind acting on the surface contained between these two faces, which has to be overcome in opening the valve.

Another novelty in this organ is the arrangement of the trunks or passages conveying the compressed air from the bellows to the wind-chests of the sound-boards. These are, in large organs, of considerable size, and, as usually placed, come very inconveniently in the way of the various movements and machinery connected with the keys, stops, composition pedals, &c. Mr. Hill dispenses with them altogether, by making the framing and main standards which support the sound-board, *hollow*, and using them as wind passages. This ingenious contrivance leaves the space under the sound-boards completely free and open, and gives increased facilities for the beneficial arrangement of the action.

* See "Pole on the Cornish Engine." Arts. 112 to 115.—Weale, London, 1844.

There are two bellows, one for the ordinary pressure, and one for the highly compressed air required for the "tuba mirabilis." They are both worked by the same handle, and are so connected that any escape, by over-blowing the high-pressure bellows, is not lost, but passes into that of the lower pressure.

The whole of the pipes are enclosed in a box, having moveable Venetian shutters in front; so that the entire organ forms one large swell: within this is also contained another box, with a similar Venetian front, enclosing the organ of the upper clavier: this latter, therefore, forms a swell within a swell, and its sound, when both are shut, is very subdued.

Each of the two pedals working the two sets of shutters is furnished with a rack and self-acting catch, which cause it to remain stationary at any point it is set to by the player; by placing, however, the foot on a particular part of the pedal, the catch is thrown out of gear, and the pedal follows the foot up or down, in the ordinary way.

This organ has no case,—the whole of the machinery being exposed to view. The wind-chest is provided with a glass front, by which the peculiar construction of the valves may be seen.

Messrs. Gray and Davison exhibit three organs, viz., a large church organ, placed in the gallery at the extreme eastern end of the building; an improved barrel organ, and a small church organ in the north gallery of the transept.

The large church organ has three rows of keys, and 34 stops, viz.,—

Great Organ (middle clavier).

1.	Double open diapason	Open 16 feet.
2.	Open diapason	Open 8 feet.
3.	Open diapason	Open 8 feet.
4.	Stopped diapason	Stopped 8 feet.
5.	Octave	Open 4 feet.
6.	Flute	Stopped wood 4 feet.
7.	Twelfth	Open 2⅔ feet.
8.	Fifteenth	Open 2 feet.
9.	Flageolet	Open wood 2 feet.
10.	Sesquialter	Compound 3 ranks.
11.	Mixture	Ditto 2 ranks.
12.	Posaune	Reed 8 feet.
13.	Clarion	Reed 4 feet.

Choir Organ (lower clavier).

1.	Dulciana	Open 8 feet.
2.	Keraulophon	Open 8 feet.
3.	Stopped diapason bass	Stopped 8 feet.
4.	Clarionet flute	Half stopped wood 8 feet.
5.	Octave	Open 4 feet.
6.	Flute	Open wood 4 feet.
7.	Fifteenth	Open 2 feet.
8.	Clarionet	Reed 8 feet.

Swell Organ (upper clavier).

1.	Bourdon	Stopped 16 feet.
2.	Open diapason	Open 8 feet.
3.	Stopped diapason	Stopped 8 feet.
4.	Octave	Open 4 feet.
5.	Fifteenth	Open 2 feet.
6.	Sesquialter	Compound 3 ranks.
7.	Cornopean	Reed 8 feet.
8.	Oboe	Reed 8 feet.
9.	Clarion	Reed 4 feet.

Pedal Organ.

1.	Grand Open diapason	Open wood 16 feet.
2.	Grand Bourdon	Stopped 16 feet.
3.	Grand Octave	Open 8 feet.
4.	Grand Bombarde	Reed 16 feet.

The compass of the great and choir organs is from C to F, four and a half octaves; the swell organ is an octave less, extending only down to tenor or 4-feet C. The clavier has, however, the same compass as the other two, the notes below 4-feet C playing on the choir organ. The compass of the pedals is two octaves and a third, from C to E.

The stop called *keraulophon** is the invention of this firm, and was first introduced by them in the organ at St. Paul's Church, Wilton-place. It consists of an open metal pipe, having a sliding tube at the top, pierced with a hole in the side. It gives a very agreeable tone, intermediate in character between a flute stop and a horn or soft reed.

There are five coupling stops. The first couples the swell upon the great organ manual, and the second upon the choir. A third causes the pedals to pull down the lower keys of the great organ, and a fourth answers the same purpose for those of the choir. The fifth coupler brings the pedals on the swell an octave higher; the lowest note acting on 4-feet C, and the upper one extending high into the treble part of the clavier; by which means a *canto firmo* may be played by the pedals in the tenor part, or even in the soprano, if required.† There is another coupling apparatus, in the form of a pedal, which brings the great organ upon the swell; this is called the *sforzando* pedal, its use being to give a sudden *forte* while playing on the swell organ.

There are six composition pedals for changing the stops. The first two belong to the swell,—one bringing on the two

* From κερας, a horn, αυλος, a flute, and φωνη, sound;—an ingenious and appropriate name, albeit rather pedantic. "Horn-flute" would have answered the purpose, with the advantage of being intelligible to the multitude.

† *Vide* several such arrangements in the *Choral Vorspiele* of Sebastian Bach.

stops marked 3 and 7; the second the full swell organ. The other four pedals belong to the great organ; the third gives stops Nos. 2, 4, 6, and 9; the fourth Nos. 1, 2, 3, and 4; the fifth brings on a *forte* combination, consisting of Nos. 1, 2, 3, 4, 5, 7, 8, and 10; and the sixth gives the *fortissimo* or full organ.

The swell box has a double set of Venetian louvre boards, one in front of the other, the more effectually to shut in the sound. They are both acted on by the same pedal.

The bellows are of the double construction, and placed outside the organ case. They are two in number, giving different pressures of wind; the higher pressure applies to the pedal organ, the lower one to the remainder of the instrument.

The barrel organ exhibited by Messrs. Gray and Davison is on a new principle, patented by them. As the general construction of a barrel organ may be assumed to be known to our readers, it will merely be necessary to explain how the present apparatus differs from the ordinary plan. Its object is to avoid the trouble of changing the barrels. Only a very limited number of tunes, say about 10 or 12, can be set on one barrel; and, according to the usual arrangement, whenever others than these are wanted, the barrel has to be taken out, and another substituted;—a work requiring much time and trouble, as well as, if the barrels are large and heavy, no inconsiderable amount of exertion. To avoid this, the patentees hang the centres of all the barrels on the circumference of a centre wheel, by simply turning which any barrel can be brought under the keys, into the proper position for playing. On the axle of the wheel is a screw, working into a fixed nut; so that when the wheel is made to revolve, it acquires thereby also a lateral motion, which answers the purpose of the lateral shifting of the ordinary barrels in changing the tune. For example, supposing any given barrel to be placed opposite the keys, and the centre wheel then turned through a whole revolution, so as to bring that barrel to the same place again, the whole apparatus will, during such revolution, have moved laterally through the distance necessary to bring another tune on that barrel into gear; and so on for all the others. It follows from this that a certain lateral position of the apparatus always corresponds to a certain tune, and the name of the tune in gear at any time is shewn on the outside of the case by a sliding index, worked by a rack and pinion from the axle of the wheel. By this improvement the organ can be set for any tune, on any barrel, with more accuracy and facility than can be obtained by the ordinary plan on one barrel only.

The present instrument is a small one, containing thirty psalm tunes on three barrels, and has three stops. The tunes are arranged in four distinct parts, so that the organ may be used to lead a choir of voices if required.

This organ is not enclosed in a case, but the whole of the machinery is exhibited to view. The framework is so constructed that there is no necessity to take the instrument to pieces for removal or exportation.

The same firm also exhibit a small church organ, with one row of keys, and a pedal clavier. There are eight stops to the manuals, and one (16 feet) to the pedals. It has also couplers and composition pedals, and the whole is enclosed in a case, having Venetian swell shutters in front.

Mr. Willis exhibits a large organ of three claviers and 70 stops, erected in the gallery at the western end of the building. Its contents are as follows:—

Great Organ (middle clavier).

1.	Double diapason	Open 16 feet.
2.	Bourdon..............................	Stopped 16 feet.
3.	Open diapason	Open 8 feet.
4.	Open diapason	Open 8 feet.
5.	Stopped diapason	Stopped 8 feet.
6.	Principal	Open 4 feet.
7.	Principal	Open 4 feet.
8.	Wood-flute	Open wood 4 feet.
9.	Twelfth	Open $2\frac{2}{3}$ feet.
10.	Fifteenth	Open 2 feet.
11.	Fifteenth	Open 2 feet.
12.	Piccolo	Open wood 2 feet.
13.	Doublette	Open 1 foot.
14.	Sesquialter	Compound 3 ranks.
15.	Fourniture	Ditto 3 ranks.
16.	Mixture	Ditto 3 ranks.
17.	Trumpet	Reed 16 feet.
18.	Trumpet	Reed 8 feet.
19.	Clarion	Reed 4 feet.
20.	Octave clarion	Reed 2 feet.

Choir Organ (lower clavier).

1.	Bourdon..............................	Stopped 16 feet.
2.	Open diapason	Open 8 feet.
3.	Dulceana	Open 8 feet.
4.	Viol di gamba	Open 8 feet.
5.	Stopped diapason	Stopped 8 feet.
6.	Viola	Open 4 feet.
7.	Flute,—metal	Stopped metal 4 feet.
8.	Flute,—wood	Open wood 4 feet.
9.	Principal	Open 4 feet.
10.	Piccolo	Open wood 2 feet.
11.	Fifteenth	Open 2 feet.
12.	Corno di bassetto	Reed 8 feet.
13.	Cremona	Reed 4 feet.
14.	Oboe,—orchestral	Reed 8 feet.

Swell Organ (upper clavier).

1.	Double diapason	Open 16 feet.
2.	Double dulceana	Open 16 feet.
3.	Open diapason	Open 8 feet.
4.	Open diapason	Open 8 feet.
5.	Dulceana	Open 8 feet.
6.	Viol di gamba	Open 8 feet.
7.	Stopped diapason	Stopped 8 feet.
8.	Flute	Open wood 8 feet.
9.	Principal	Open 4 feet.
10.	Principal (soft quality)	Open 4 feet.
11.	Twelfth	Open $2\frac{2}{3}$ feet.
12.	Fifteenth	Open 2 feet.
13.	Fifteenth (soft quality)	Open 2 feet.
14.	Dulcimer (soft quality)	Compound 3 ranks.
15.	Sesquialter	Ditto 3 ranks.
16.	Fourniture	Ditto 3 ranks.
17.	Mixture	Ditto 3 ranks.
18.	Trombone	Reed 8 feet.
19.	Trumpet	Reed 8 feet.
20.	Clarion	Reed 4 feet.
21.	Hautboy	Reed 8 feet.
22.	Cremona	Reed 8 feet.

Pedal Organ.

1.	Double-double diapason	Open wood 32 feet.
2.	Double diapason	Open wood 16 feet.
3.	Double diapason	Open metal 16 feet.
4.	Violon (soft quality)	Open metal 16 feet.
5.	Bourdon	Stopped 16 feet.
6.	Octave,—wood	Open wood 8 feet.
7.	Octave,—metal	Open metal 8 feet.
8.	Quint	Open $5\frac{1}{3}$ feet.
9.	Super octave	Open 4 feet.
10.	Sesquialter	Compound 3 ranks.
11.	Mixture	Ditto 3 ranks.
12.	Tromba	Reed 16 feet.
13.	Trombone	Reed 8 feet.
14.	Clarion	Reed 4 feet.

The compass of all the three manual organs is the same, viz., $4\frac{1}{2}$ octaves, from C up to G. The compass of the pedals is $2\frac{1}{2}$ octaves, from C to G.

The stops in the great organ require no comment, further than to explain that whenever two stops of the same name occur, as 3 and 4; 6 and 7; 10 and 11; they are voiced to different qualities of tone.

The choir organ contains principally solo stops. The *viol di gamba* is an open metal pipe of a small scale, tapering upwards, and terminating in an inverted cone; it produces a thin quality of tone. The *viola* is of the same quality, but speaks an octave higher. The *metal flute*, No. 7, is a *flute-a-cheminée*. The *corno di basetto* is a reed-stop, with a tone like a clarionet. The *cremona* is similar, but speaks an octave

higher. The *orchestral oboe* is peculiarly voiced to imitate the instrument whose name it bears.

The swell organ is unusually large. The box containing it is 12 feet square, and 14 feet high. The stops marked Nos. 2, 5, 10, 13, and 14, taken together, form a complete full organ, of a "dulceana" or soft quality throughout; the effect of which, when the swell is shut, is very remarkable, resembling a band at a distance. By the new stop movement (hereafter explained), it can be alternated with the full swell with great facility, by which striking and novel effects may be obtained.

The Venetian shutters of the swell-box are made to fit very closely, by which the sound is much subdued. It is often found in large organs that there is a difficulty in doing this, in consequence of the necessity of providing apertures for the escape of the large quantity of wind passing through the pipes; and it has been remarked that, if sufficient opening be not left for this purpose, the pipes will be sluggish in speaking, or will sound out of tune. Mr. Willis has overcome this difficulty in an ingenious manner, by placing within the swell-box, a separate bellows, used to supply the swell organ. By this contrivance the wind, instead of escaping out of the box, circulates continually within it, and thus the box may be made perfectly tight without inconvenience.

Both the great and swell organs have the pneumatic lever (hereafter described in the French organ) applied to the keys, by which the touch is rendered light and agreeable. Mr. Willis has introduced, however, modifications in its application: he dispenses with the higher pressure of wind, using only such as is given by the bellows for supplying the organ in general, and adopts an improved valve for the more instantaneous exhaustion of the air.

There are four different pressures of wind used in this organ,—one for the flute-stops in the swell, a higher pressure for the pedals, a higher still for the great and choir organs, and the highest for the swell reeds. Each of these different pressures is given by a separate bellows, and four men are required to blow when the full organ is used.

There are seven couplers, namely,—to bring the swell or the choir on the great organ; the great or the choir on the swell; and the pedals on either of the three manual claviers.

The principal novelty in this organ is a contrivance for acting on the draw-stops, intended to supersede the composition pedals. On the key slip, which is of brass, immediately below each clavier, project a number of small studs, each of

which corresponds to, and is labelled with, a certain combination of stops belonging to the clavier adjoining; when the hands are upon the keys, these studs, lying directly below, can be touched easily with the thumbs, and when any one of them is slightly pushed in, in this manner, it draws the combination of stops to which it corresponds, in the same manner as the composition pedals. This is effected by the aid of a pneumatic apparatus, on the same principle as that applied to the keys. The stud, on being touched, admits compressed air into a bellows, which immediately rises with sufficient power to act, by means of rods and levers, on the machinery of the stops, drawing out those which the given combination requires, and pushing in those that are superfluous. In most cases there is a duplicate stud for each combination, so that it may be obtained by using either the right or left-hand.

The valve used to admit the wind to the pipes in the pedal organ is of a new construction. It is formed by covering the aperture with a piece of leather or other flexible substance, fixed at one end, and attached at the other end to a wooden roller. When this roller is moved, by a wire attached to the pedal key, it wraps the leather round it, and so uncovers the opening; when the key is let go, a spring brings the roller back, and, by unrolling the leather, covers the aperture again.

The valve used for the choir organ is also of a new construction, designed with the object of reducing the force necessary to open it. It may be described as an ordinary valve or pallet, having fixed in the middle of it, on the under side, a small bellows, of the single kind: the upper board of this is formed by the valve itself,—the lower one is *fixed* by a screw. The effect of this is, that the pressure of the wind upon the valve is not exerted over its whole area, but is only what is due to the difference between the area of the valve and that of the lower board of the small bellows. By this means a large opening may be obtained with a light pressure.

The novelties above described, namely, the placing the bellows inside the swell-box; the arrangement for drawing the stops; the pedal valve; and the choir organ-valve; as well as some improvements in the pneumatic apparatus, and in the construction of the mechanical details of the organ, are protected by a patent dated 28th February, 1851.*

The dimensions of the organ are about 25 feet wide, 23 feet deep, and 30 feet high: it stands upon 575 superficial feet area, and its solid contents are 17,250 cubic feet. It con-

* We may probably give a more detailed description of Mr. Willis's patented improvements in a future number of this Journal.

tains about 4500 pipes. Its composition, as exhibited in column 14 of the table, at page 191, will shew that it is worthy of being compared with some of the largest organs in the world.

Mr. Bishop exhibits a small cabinet organ, with one row of keys and an octave of pedals, and five stops. It contains the two inventions of this builder, described on page 115, namely, the composition pedals (in this organ five in number) and the anti-concussion apparatus for steadying the wind.

Mr. Walker exhibits a small organ, in a highly-ornamented gothic oak case; it has one row of keys, $2\frac{1}{4}$ octaves of pedals, and nine stops, including pedal-pipes. There are four composition pedals for changing the stops, and a coupler to throw the pedals on or off the manual clavier at pleasure.

Mr. G. M. Holdich exhibits an organ of three stops, with a coupler to cause each key to take down the octave above (see page 115, and also the description of the French organ); this the builder calls a "diaocton."

Mr. H. Bryceson exhibits a barrel organ of six stops, with three barrels, each playing 12 tunes.

Mr. T. F. Room, a manufacturer of metal organ-pipes, exhibits a set of specimens of various flute and reed-stops, made in two different kinds of metal.

Mr. Dawson exhibits a mechanical organ on a new construction, which he calls an *autophon*, and for which he has a patent. This instrument has no wind-chest, valves, or keys, but the wind is conveyed directly from the bellows to the channels of the sound-board by a row of passages, which are cut through transversely by a long horizontal slit, just large enough to admit a sheet of pasteboard. This pasteboard is pierced with a number of holes, corresponding to the given tune to be played, and is drawn through the slit by rollers, turned by a winch; when, therefore, the holes come opposite the passages in succession they admit the wind to the sound-board, and cause the corresponding notes to play. This instrument might be called a *jacquard* organ. It is simple, and does away with barrels, and many other expensive parts; but it has the disadvantage of admitting the wind gradually into the pipes, and cutting it off gradually from them; the effect of which is a disagreeable wavering at the commencement and termination of the note.

A curious instrument is exhibited in the north gallery, called the *enharmonic organ*. It is built by Messrs. Robson, to the design of Col. T. Perronet Thompson, M.P., and its object is to get rid of what is called *temperament*, and to give the power

of playing strictly in tune, which (as is well known to those who have studied the theory of harmonics) cannot be done according to the ordinary duodecimal division of the octave. Attempts have often been made to diminish this evil, but the present one is more comprehensive than any that have preceded it. The instrument contains *forty-two* different sounds in the octave, distributed on three claviers, and music may be executed on it in a great variety of keys, perfectly in tune in all. The lower clavier corresponds to the key of C, and the notes E-flat, E, F, F-sharp, G, A-flat, and A, are tuned to form correct intervals with the key-note. The other notes, namely the major and minor second, and the major and minor seventh, require each to be *double,* to form perfect consonances with the other notes of the scale; for example, the same D which makes a correct fifth to G, will not form a correct fourth to A, but will be a "comma" too sharp, and so on for the rest. There are therefore two finger keys to each of these notes, conveniently placed so that either of them can be played at pleasure. The finger keys of the clavier are not coloured in the ordinary way, but the white and black are so distributed that those of similar colour will make concords in tune with each other. The second clavier is formed upon the key of E, and the upper one on that of D; and each clavier has a few extra notes in addition to those already mentioned, by the aid of which the three claviers together give a range of about twenty keys, in any of which music may be played without any imperfect or "tempered" intervals being used. The organ is tuned by a "Phonometer or monochord," acted on by weight, and has an ingenious method of correction for changes of temperature.*

* A more detailed description of this instrument is contained in a pamphlet by Col. Thompson, published by Effingham Wilson, Royal Exchange. It gives much valuable matter on the subject of intonation, and the author exposes, with much force and vivacity, the absurdity of the common practice of blaming nature for the defects of the ordinary artificial musical scale. The well-known complaint, that a succession of twelve perfect fifths do not exactly correspond with seven octaves (a so-called anomaly, which has seriously been ascribed to a mysterious exercise of Divine power!) proves, when investigated, to be merely a statement of a mathematical truism, namely, that $\left(\frac{2}{3}\right)^{12}$ is not $= \left(\frac{1}{2}\right)^{7}$;—to complain of which, says Col. Thompson, is just as reasonable as to complain that twice three is not five! The only tenable defence of our usual duodecimal scale is, that it combines comprehensiveness with simplicity, and with only a small amount of error.

We are informed that the subject of just intonation on keyed instruments is at present exciting much attention in America.

Foreign Organs.

In the western division of the nave stands an organ, in a gothic oak case, exhibited by M. Ducroquet, of Paris. It has two rows of keys, and twenty stops, as follows:—

Grand Orgue (lower clavier).

1.	Bourdon	Stopped 16 feet.
2.	Bourdon	Stopped 8 feet.
3.	Montre	Open 8 feet.
4.	Flute	Open 8 feet.
5.	Salicional	Open 8 feet.
6.	Prestant	Open 4 feet.
7.	Plein jeu	Compound 5 ranks.
8.	Bombarde	Reed 16 feet.
9.	Trompette	Reed 8 feet.
10.	Clairon	Reed 4 feet.

Récit, or Swell (upper clavier).

1.	Bourdon	Stopped 8 feet.
2.	Flute harmonique	Open 8 feet.
3.	Viola di gamba	Open 8 feet.
4.	Flute	Open 8 feet.
5.	Prestant	Open 4 feet.
6.	Trompette	Reed 8 feet.
7.	Hautbois et basson	Reed 8 feet.
8.	Cor Anglais	Free reed 8 feet.

Pedal Clavier.

1.	Flute	Open wood 16 feet.
2.	Bombarde	Reed 16 feet.

The compass of the two manual claviers is from C to C, five octaves; that of the pedals from C to C, two octaves.

In the great organ the following stops require special mention. The *bourdons* are stopped pipes,—the lower part of wood, with a solid plug, but the upper part of metal, with a tube through the stopper; these pipes being in fact *flutes à cheminée.* The *montre* is of tin, and, as its name implies, is the stop to which the front pipes of the case belong. The 8-feet *flute* is a pipe of new form, with a bell-shaped top, and called *flute-à-pavillon;* the tone is peculiarly full and clear. The *salicional* is an open metal pipe of a small scale, resembling what in English organs is called the "dulceana." The *plein-jeu* comprehends the twelfth, fifteenth, and three ranks above, repetitions of the fifth and octave: the French compound stops rarely contain the interval of the third.

The *récit* or swell, to which the upper clavier belongs, is enclosed in a box, with Venetian shutters in front. It contains several novel and remarkable solo stops. The *flute harmonique* is composed of pipes double the usual length, which overblow, and sound their octave above; it is powerful, and gives, when used as a solo, a very effective imitation of an orchestral flute.

The *viola di gamba* is an open metal stop, of a very small scale, much smaller than the salicional; it produces a thin reedy tone, approaching that of stringed instruments, particularly in its lower notes, which may be compared with those of the violoncello. This resemblance is rendered the more striking, as each note is preceded by a harmonic sound, which recalls the effect of the bow in attacking the string. The *hautbois* and *basson* form one stop,—the former belonging to the treble, the latter to the bass; they are reed-stops, constructed and voiced in a peculiar manner. The *cor Anglais* is a reed-stop, but on a different principle to the ordinary kind,—the reed being *free* and not beating against a fixed surface; it gives an excellent imitation of the instrument whose name it bears, or the *corno di bassetto*. The free-reed stops have been lately extensively introduced into organs by the French, but are not used by English builders.

The reed-stops in this organ are more numerous than is usual in instruments of this size. The reed of 16 feet on the keys is very rarely found in English organs. All the reed-stops in the great organ are placed upon a separate wind-chest, and are supplied with wind at a higher pressure than is used for the flute-stops. They are very powerful and effective, and give to the full organ that brilliant effect peculiar to French instruments.

There are seven mechanical pedals. The first causes the keys of the pedal clavier to act on those of the great organ. The second gives the power of throwing the great organ action on or off the great organ keys; so that (supposing the swell coupled upon this manual by pedal No. 3) a sudden *forte* or *piano*, of great effect, may be obtained. The third pedal couples the swell to the great clavier in unisons; the fourth couples it an octave above; and the fifth an octave below. The effect of these is extraordinary; an 8-feet stop may be converted into a 16-feet or a 4-feet, at pleasure; and a great variety of effects and combinations may be produced, which otherwise would be unattainable without increasing almost indefinitely the size of the organ. The sixth pedal brings the reed-stops upon the great organ; and the seventh opens the Venetian shutters of the swell-box.

The most important feature of this organ, however, is the *pneumatic lever*, applied here by its inventor, Mr. Barker. Its object is to lighten the touch. We have already stated, that in large organs the force necessary to open the valves becomes a great inconvenience, and many contrivances have been devised, tending to diminish the evil in a greater or

less degree; but the pneumatic apparatus must be allowed to be the most complete and effectual of any, inasmuch as it gets over the difficulty at once, by rendering the resistance of the keys altogether independent of the work they have to perform. Mr. Barker, after having tried and rejected valve-modifications designed with this end, and being convinced of the inexpediency of restricting the size of the openings or the pressure of wind employed, conceived the bold idea of overcoming the heavy resistances by means of an *auxiliary power*, which the keys of the instrument should merely have to put in action and to control. This power was compressed air. In his first attempts he adapted to each note of the instrument a piston, working in a small cylinder, and the rod of which communicated with the machinery to be moved. The key opened a small valve and admitted into the cylinder air compressed to a high pressure, which lifted the piston, and thereby opened the valves of the sound-board. This arrangement of the apparatus, however, was expensive and unusual, and required the air to be considerably compressed; the inventor therefore soon modified it into a more simple shape, and one more akin to the general routine of organ manufacture. For the cylinder and piston he substituted a small bellows, which could easily be made of such a size as to give the requisite power without an inconvenient pressure of wind; and in this state the apparatus now remains. The key of the clavier opens a small valve, which admits the compressed air, furnished by bellows for the purpose, into a machine precisely similar to a pair of ordinary single hearth bellows, but only a few inches long and broad; the lower board of this is fixed; the upper one rises when the wind is admitted, and carries with it a rod, communicating with the whole of the valves, coupling movements, &c., which have to be moved, and which therefore answer immediately to the putting down of the key: when the key is released from the finger, the valve which admitted the air is shut and another opened, to allow of its escape; the bellows then immediately descend. It is easy now to see that the key is entirely relieved from the resistance of the main valves, couplers, &c., having merely to open the small valve of the pneumatic apparatus; and this is so light as scarcely to be felt by the finger. The touch, therefore, can be adjusted to any degree of elasticity convenient to the player,—all the resistance of the machinery beyond, being overcome by the auxiliary power. The effect, indeed, of this apparatus is to transfer the labor of playing entirely to the bellows-blower, leaving the organist

at liberty to exercise, unconstrained by mechanical exertion, his more intellectual powers. The advantage of this can only be fully appreciated by those who have toiled under the fatigue of playing a large organ on the ordinary plan.* But, independently of this, it offers great advantages in the construction of a large organ, inasmuch as it removes all limits to the supply of wind, either as regards quantity or pressure, and gives, without the slightest addition of difficulty to the player, the power of adapting couplers and other mechanical contrivances, which, under the ordinary system, would become altogether impracticable. The three couplers already described in this organ, and the double arrangement of valves necessary to admit the higher pressure of wind to the reed-stops, are instances of the application of these advantages. The action of the pneumatic lever is instantaneous, rising and falling simultaneously with the motion of the keys; and the notes may be repeated with facility.†

The organ is tuned on a temperament more equal than is usual in England, by which the extreme sharp and flat keys are rendered better in tune.

The internal arrangement of the organ is somewhat novel, and contains several ingenious contrivances for simplifying the machinery, and rendering all the parts easily accessible.

The dimensions of the organ are 30 feet high, 12 feet broad, and 6 feet deep. The claviers are fixed in a detached upright console,—the player sitting with his back turned to the instrument itself. This arrangement is frequently adopted in Roman Catholic countries, for the sake of enabling the

* The organist at Haarlem is obliged to strip like a blacksmith for his usual hour's performance; and, at the end of it, retires covered with perspiration.

† Although the pneumatic lever was first used in France, it is an English invention. Mr. Barker is a native of Bath, and endeavoured, in the first instance, to introduce his apparatus in England, about 1832, or the time when the large organs of York and Birmingham were in course of erection. Experience, however, in large organs, was then wanting in this country, and his endeavours were unsuccessful; he therefore went to France, where the subject was better known, and where the value of the new principle was at once appreciated. It was introduced by M. Cavaillé immediately, in the great organ building at St. Denis (1841), and has since been applied, together with the improvements to which it has given rise, in a considerable number of large instruments in the principal churches of France. Shortly after the erection of the St. Denis organ, Mr. Barker took the management of the business of Messrs. Daublaine and Callinet, now Ducroquet, and has constructed some of the largest organs in France. Although, therefore, the organ we are now describing is built by French enterprize, and on the French plan, much of the constructive merit it displays may be claimed for England.

It is right to state that there are other claimants to the invention of the pneumatic lever.

organist to watch the progress of the service in the church, and to introduce the required music at the proper times.

M. Schulze, of Paulinzelle, near Erfurt, exhibits an organ of two claviers and 16 stops, namely:—

Lower Clavier.

1.	Bordun	Stopped 16 feet.
2.	Principal	Open 8 feet.
3.	Gamba	Open 8 feet.
4.	Hohlflöte	Open wood 8 feet.
5.	Gedact	Stopped 8 feet.
6.	Octave	Open 4 feet.
7.	Mixtur	Compound 5 ranks.
8.	Clarinette	Reed 8 feet.

Upper Clavier.

1.	Lieblich Gedact	Stopped 16 feet.
2.	Geigen Principal	Open 8 feet.
3.	Lieblich Gedact and Flauto traverso	Stopped } Open wood } 8 feet.
4.	Geigen Principal	Open 4 feet.
5.	Flöte	Open wood 4 feet.

Pedal Clavier.

1.	Sub-bass	Stopped 16 feet.
2.	Octave-bass	Open wood 8 feet.
3.	Posaune	Reed 16 feet.

The compass of each of the manual claviers is $4\frac{1}{2}$ octaves, C to F,—that of the pedals is a little above two octaves, from C to D. The organ to which the upper clavier belongs is not enclosed, and does not therefore form what we should call a *swell*.

The *Bordun* (bourdon) and *Gedact* are stopped wood pipes, corresponding with our "stopped diapason." The *lieblich Gedact* is the same, but on a smaller scale, and differently voiced. The *Principal* corresponds with our "open diapason." The *Gamba* and *Geigen Principal* are open metal pipes, of a small scale. The *Hohlflöte* is an open wood pipe, peculiarly voiced. The *Mixtur* consists of the octave, twelfth, fifteenth, nineteenth, and twenty-second, but contains no interval of the third. The stop marked No. 3, in the upper clavier, consists of two pipes; one being a stopped pipe, the other an open wood one, turned and bored of a *cylindrical form,* and called the *flauto traverso*: the upper part of this stop consists of pipes of double length, which overblow and speak their octave. The *Flöte,* on the upper clavier, is the same as the *flauto traverso.* There are only two reed-stops, the *Posaune* in the pedals, and the *Clarinette* in the great organ; they are free reeds, with conical tubes made of zinc, and covered at the top with thin gauze, by which the sound is softened.

There are two couplers, to bring the upper clavier upon the lower one: one of these acts on the unison note, the other on the octave below. The pedals act on the great organ,—but this is done by an internal movement, without pulling the keys down;—a great convenience, as it does not interfere with the hands.

The pedal clavier is constructed in a novel manner. Instead of lying in a horizontal plane, parallel to the floor, as is the customary plan, in this instrument the keys are disposed in the form of a curve, concave upwards; so that the notes at the extreme right and left of the clavier, stand higher than those in the middle: the object of this is to render these extremes more conveniently accessible to the feet, so that they may be played with less exertion and derangement of the body, than in the ordinary plan. The pedal keys are further apart, and broader on the face, than in English organs: their distance, from centre to centre, is $3\frac{1}{8}$ inches, and they are nearly an inch broad; whereas, in England, they are usually made only about $2\frac{1}{4}$ inches apart, and half an inch broad. The larger dimensions are common in Germany.

The bellows are two in number, and of the single construction, each consisting of an upper and lower board, connected together with leather sides, similar to a pair of domestic bellows, but much larger, and provided with valves at the points of exit as well as entrance of the air. The lower board is fixed, and to the upper one is attached a lever, by which the bellows are raised and caused to draw in air from the atmosphere; when the lever is free, the weight on the upper board of the bellows forces the air into the wind-chests of the organ. The ends of the two levers project from the frame of the organ, at a short distance apart, and the blower moves them, not by manual labor, as with us, but by *stepping* upon them, and allowing the weight of his body to bring them down, and so raise the bellows. They are moved alternately, so that while one bellows is being filled, the other may always be affording its supply. This mode of blowing (somewhat resembling the working of a tread-mill) is common in Germany.

Most of the stops of this organ are particularly powerful; they are given more wind than in our organs, not by the pressure being greater in the wind-chest (for this is only 3 inches), but owing to the apertures at the foot and mouth of the pipe being much larger, and allowing the wind to pass through more freely, which, the pipes being voiced accordingly, produces a louder quality of tone.

Organs are built in great numbers in Germany, and are

made very cheaply. This one is an example,—the value of it being estimated at only about 1400 thalers, or £210 sterling.

Messrs. A. and M. Ducci, organ-builders, of Florence, send to the Exhibition two instruments, possessing considerable novelty.

The first is an organ, the peculiarity of which is its small size in proportion to its contents. It has six stops throughout the usual compass of 4½ octaves on the keys, and an octave of notes extending down to 16-feet C on the pedals, and yet the dimensions of the instrument are only 5 feet 6 inches high, 3 feet 6 inches wide, and 1 foot 11 inches deep. The stops are,—

1. Unison or 8 feet open (the lower part stopped).
2. Octave or 4 feet.
3. Fifteenth.
4. Nineteenth.
5. Twenty-second.
6. Unison or 8 feet reed stop, or trumpet.

The pipes of all these stops are very ingeniously formed and arranged, so as to occupy the least possible space, and, at the same time, to be accessible for tuning. The pipes are fixed in their places by springs, so that the instrument may be transported entire, from place to place, without danger of derangement. The bellows possess a novelty in that the feeder (consisting of a moveable board between two fixed ones) is double-acting, supplying wind both by its upward and downward motion.

The principal novelty, however, is in the pedal notes, which, although 12 in number, beginning with 16-feet C, are all produced from one pipe, about 4 feet long, contained in the stool on which the organist sits. Messrs. Ducci have, in the first place, found a means of so varying the proportions and make, as to cause a stopped pipe, of 4 feet long, to sound a 16-feet note, of 8 feet a 32-feet note, of 2 feet an 8-feet note, and so on; and, secondly, they have made the same pipe speak different notes, by opening holes, situated at certain distances in one of its sides, on the principle of the flute and other orchestral wind instruments. By applying therefore the pedal keys to move valves covering these holes, the whole range of an octave of pedal notes is produced by a simple and inexpensive means; which, if perfected and extended, would certainly bring about a revolution in organ building. A great advantage, independent of the portability and cheapness, is stated to be, that the pipe, being of so much smaller a size than usual, consumes much less wind.

Messrs. Ducci have also applied this principle to the con-

struction of a separate instrument, which they term the *baristate,* and which is intended to give grave tones in an orchestra. It consists of three or four pipes, of the construction above described, with keys attached to open the holes in the sides. A bellows, worked by the feet or by a separate blower, furnishes the whole with wind. The compass is about two octaves, commencing, in one instrument, with the G, in another with the E flat, above 32-feet C. The wood sides of the pipe are so formed as to vibrate with the air, giving a powerful reedy reinforcement to the tone; which, however, can be varied in intensity, or stopped altogether, by means of a regulating screw. The size of the pipe giving, when entirely closed, the note C sharp of 16 feet,—is 4 feet long, 7 inches broad on the side where the mouth and the openings are placed, and 20 inches deep. Probably it is this great proportional depth that gives the increased gravity of the tone. This instrument has received high praise from Rossini and other celebrated musicians.

FREE-REED INSTRUMENTS.

A CLASS of keyed musical instruments has lately come into extensive use, combining, in a remarkable degree, the advantages of volume of tone, compass, the power of *sostenuto,* and expression, and having, in addition, the useful qualifications of simplicity of construction and smallness of size. Instruments of this class exist in different forms, and under various names; but, as they are all modifications of the same principle, we have classed them together under the above title. The tones are produced in each by what is called the *free-reed,* an apparatus, the construction of which will be understood from the following description.

In the ordinary reed-pipe of an organ (a description of which is given at page 50, *ante*) the sound is produced by the vibration of a thin tongue of metal, allowed to beat upon the flattened side of a tube, and so alternately to cover and uncover a slit or opening, through which the air passes into the pipe above. Now, let us suppose that the brass tongue (which, in the above case, must of course be large enough to cover the opening entirely, and to bear on its margin) be made a little smaller, so as not to cover the opening, but just to enter into it without touching. The consequence will be, that when the reed is set in vibration, it will no longer *beat* against the plate, as in the ordinary organ reed, but will oscillate *freely,* entering the opening and leaving it again at each vibration. It is obvious that, since the tongue is made to close the opening as nearly as possible, it will check, in every vibration, the current of air passing through, in the same manner as the beating-reed; and the effect will therefore be, as in that case, a series of pulsations in the air, producing a musical tone.

This disposition of reed is called a *free-reed,* and it has several advantages over the beating one, which have led to its adoption in the class of instruments we are now describing.

In the first place its tone is of a more agreeable quality, more smooth and mellow, and free from the tendency to become harsh and snarling, which often exists in the beating-reed.

Secondly, it requires no pipe, which, in the beating-reed, is always necessary to modify the tone; without this addition, indeed, the ordinary organ reed-stops would be unendurable. The importance of this advantage, as regards simplicity, cheapness, and compactness, must be self-evident.

Thirdly, it is less liable to get out of order;—the beating of the ordinary reed is constantly tending to produce derangement, and to throw it out of tune; the free-reed, encountering no obstacle in its vibration, is much less liable to be disturbed.

Fourthly, it gives an entirely new property, which the ordinary organ does not possess, namely, the power of *expression*. The beating-reed gives but the one grade of tone it is voiced to, without variation, and will only speak properly under the pressure of wind it is originally constructed for; but the free-reed has the valuable peculiarity, that, by varying the pressure of the wind, the power of the tone may be varied at pleasure, without altering the pitch. The reason of this is found in the well-known fact, that the vibrations of an elastic body will be isochronous, no matter what the extent of the oscillation may be. The effect of a more powerful wind is to increase the arc of vibration, and the greater impetus of the passing air gives a more powerful tone; but since the vibrations are performed in the same time, the pitch of the note remains uniform. By simple contrivances, therefore, for varying the pressure of the wind, the free-reed may be made to give any gradation of *piano* and *forte*, and to produce any *crescendo* and *diminuendo* effects that may be desired.

The free-reed is very ancient, having been used in China from time immemorial; its modern revival in Europe appears to be due to the efforts made to give to the organ the power of expression. About 1810, a M. Grénié constructed two instruments on this principle, one of which was sent to the Conservatoire, the other to the convent of the Sacré-Cœur, at Paris. In 1827, three stops, on the free-reed or expressive principle, were introduced into the organ at Beauvais Cathedral by a workman of M. Grénié's, named Cosyn, and who was again employed, in 1829, by M. Sebastian Erard, to execute a stop of a similar kind in an organ built by him for the Tuileries. M. Erard varied the application in a novel manner, by making the expression depend on the depth of the touch. This organ was destroyed in the revolution of July, but the free-reed stop was saved, and is still in the possession of M. Erard. The new idea embodied in it, however, has not been further carried into practice.

These attempts excited but little notice, and the use of the free-reed would probably not have been much extended, had not the principle been applied in a more popular form. About 1827, a little instrument was made in Germany,* consisting of a few simple free-reeds, fixed in a thin metal plate, and blown directly with the mouth; they were so tuned as to sound a chord when blown together, or a set of trumpet notes separately. Then came an extension, by putting several chords on the same plate, either of which could be taken at pleasure, or the notes picked out separately, so as to form a connected melody. The instrument thus improved was made in England by Messrs. Wheatstone, who called it the *Æolina*, and published, in 1829, a book of instructions for its use.†

By successive augmentations, however, the instrument soon became too large for the mouth, and the next step was to attach to it a small hand-bellows, and a set of keys, opening valves for the various notes: this formed the *accordion*, an instrument which, though exceedingly imperfect, has been the most popular of all the applications of the principle. In its smallest and simplest forms it has been made for a few pence, as a plaything for children, while in its most expensive shape it has aspired to the execution of music of no mean character. According to the usual construction, the accordion consists of a pair of rectangular single bellows, one board of which is held in each hand; so that by separating the hands the bellows are extended, and caused to draw in air; and by approaching them together, the air is forced out again. The board held in the right hand contains the reeds, with their finger-keys and valves; which are so arranged that each key covers two reeds and corresponds to two notes,—one being sounded in expanding, and the other in compressing the bellows. For example, when a certain key is opened and the bellows expanded, they will draw in air through the reed sounding C; but when compressed, they will force out the air through the reed D. Similarly, the next note will give E, by expanding, and F, by compressing, and so on; the object being to increase the compass, without augmenting the number of keys. There

* In 1829, a M. Pinsonnat patented, in France, what he called a *typotone*, viz., a single free-reed set in a plate of metal, or mother-o'-pearl, and used as a substitute for the tuning-fork or pitch-pipe. This is claimed by the French as the original of the portable free-reed instruments; but there is evidence that the German contrivance alluded to in the text was invented, and imported from Leipsic into England, by Messrs. Wheatstone, at an earlier date.

† A description of this instrument was published, in 1829, in the "Harmonicon," a monthly periodical devoted to musical subjects.

are also one or two chord keys, by opening which, the instrument will sound certain chords, giving a rude kind of accompaniment to the melody; and there is also a wind-valve, managed by the left-hand, by the aid of which the bellows may draw in or expel air when required, without causing the reeds to sound. It may be gathered, however, from this description, that the accordion is a most defective instrument, little better indeed than a toy; it will play in only the key it is constructed for, and even in this its capabilities are very limited; and though its tones are pleasing, its effects soon become monotonous and disagreeable to the educated ear.

A far more successful instrument of this kind is the *concertina*, the invention of Messrs. Wheatstone. Shortly after the introduction of the Æolina by this firm, as noticed above, they effected a considerable improvement upon it, by enclosing the reeds and plate in a small box, and adding valves to open any of the notes at pleasure: this was called the *symphonion;* the wind was supplied to the interior of the box by the mouth, and the valves were acted upon by studs projecting from the two sides, conveniently for the fingers of the right and left hand. The substitution of bellows for the action of the mouth, and certain other improvements consequent thereupon, transformed this instrument into the concertina. It consists, as now made, of a hand-bellows, with reeds and keys, something like the accordion in its general principle, but differing essentially from that instrument in the arrangement of its details. The bellows are of an octagonal shape, and the reeds and keys are contained in both boards, so as to be played on by the fingers of both hands. The keys consist of small cylindrical studs, projecting from the middle of the bellows boards, and are ingeniously arranged for facility of performance. The bellows boards are held by straps passing round the back of the hands, so that the fingers are left at liberty to act on the keys without impediment. All the reeds are in duplicate, so that, whether the bellows be expanded or compressed, the same note is sounded, and each note has a separate key. Any degree of *piano* or *forte* may be produced by using more or less force with the bellows, and the instrument thus gives great facility for expression. The concertina, though merely a hand instrument, has a compass of 3 or 3½ octaves, with a complete chromatic scale; so that melodies can be played in any key, and can be accompanied, to a certain extent (limited only by convenience of fingering) with harmonies also. The kind most used is a treble instrument, corresponding in compass with a violin; but varieties are also made to correspond

with the viola and the violoncello. It serves therefore not only for music of its own, but may also be used, in case of need, to play solos, or obligatos, written for other instruments of a different kind,—the tone and expression of which it will often imitate with tolerable effect.

The free-reed has, however, received a more extended application. In the attempt to improve the accordion, by enlarging and completing its scale, it became so unwieldy that it could no longer be held conveniently in the hands, or played upon with ease; and, as a natural remedy for this difficulty, the plan was adopted of applying a regular clavier, and furnishing the wind by separate bellows as in an organ. The instrument thus became, in fact, transformed into an organ having a free-reed stop without pipes; a return very nearly to the original application of the free-reed. The instrument was early made, in this form, in England, by Mr. Green, of Soho-square, and called the seraphine; it had a compass of several octaves, and from its cheapness and small size soon became popular. It was extensively manufactured and considerably improved in France, and in 1842, M. Martin, of Paris, introduced an improvement of considerable importance, with the view of remedying a defect previously existing to some extent, namely, the want of promptness in articulation. It consisted of a small hammer, connected with the key, which gave a gentle blow to the reed at the moment of opening the valve; the effect of this was to make the note speak with a rapidity and precision very remarkable, and to give the tone a peculiarly brilliant and agreeable quality.*

Many varieties of the free-reed clavier instrument have been made, both in England and on the continent, under various names; such as the seraphine, æolophon, physharmonica, harmonium, melodium, symphonium, poikilorgue, orgue expressif, æolomusicon, &c.; of which the Exhibition contains several examples; but, as they are all essentially the same instrument, it will be sufficient to give a description of one of the most modern and best known construction. The clavier has a compass of 5 octaves,—the lowest note being 8-feet C, corresponding with the fourth open string of the violoncello. It has four stops, divided into halves, and acted on by eight draw-stops, placed immediately over the clavier, so as to be

* It is right to state, that M. Pape, in a patent taken out in France, in 1834, and subsequently in England, in 1839, describes springs struck by a hammer, the vibration being afterwards prolonged by wind, "according to the manner of a seraphine." The difference between this and M. Martin's contrivance appears merely to be, that in the former the principal effect is due to the blow, while in the latter the percussion is subsidiary.

within convenient reach of the hands. They are named as follows in the instrument we inspected, but different terms are used by different makers:—

	Bass.	*Treble.*	
1.	Cor Anglais	Flute (Percussion)	8 feet.
2.	Bourdon	Clarinette	16 feet.
3.	Clairon	Fifre	4 feet.
4.	Basson	Hautbois	8 feet.

These are all formed with the free-reed; the two 8-feet stops are of different qualities, and one of them is acted on by the percussion movement already described. The mechanical parts of the instrument are very simple. The keys open valves, by which the wind from the bellows is allowed to act on the reeds, and the draw-stops open or close the communications with a whole row of reeds together. The bellows are of the ordinary double construction, with a reservoir, and two feeders worked by the feet of the performer. In the ordinary state of the instrument the wind is supplied to the reeds from the reservoir of the bellows, at constant pressure, as in an organ, and the tone is then of uniform strength; but there is a simple contrivance by which the power of expression is given. By drawing a stop, marked "expression," the wind communication to the reeds is cut off from the reservoir of the bellows, and opened to the feeders; by pressing the foot down, therefore, with different degrees of force, piano or forte, crescendo or diminuendo, may be obtained at pleasure; the management of this requires, however, a little practice, as the two feeders must be used alternately, to give the opportunity for replenishing them with air. In addition to the stops above named, there are others of a mechanical nature; one called the "grand jeu," which brings on the "full organ" at once, and another marked "forte," which opens a sliding shutter to increase the volume of sound, something on the principle of the swell of an organ. The "sourdine" and "celeste" are mechanical contrivances, by which the tone of certain of the stops is modified, to produce variety. The quality of tone of all the stops depends, in some degree, on their positions, and on the arrangement of the wood cases in which they are enclosed, and which act, in some measure, as sound-boards. The instrument is of small size, considering its power and capabilities; it is about 4 feet wide by 2 feet deep, and 3 feet high. The price is from 35 to 50 guineas. An instrument of this kind, constructed with two claviers and pedals, would be by far the best substitute for the organ, in chambers and other small rooms. The so-called chamber organs, consisting of three or four soft stops on one row of

keys, besides being expensive, possess very few of the qualifications of the instrument whose name they bear.

Messrs. Luff & Son, exhibit a "harmonium," nearly similar to that above described, but with the addition of a mechanical apparatus for playing it. This is on the principle of the *piano-mécanique* of M. Debain (described at page 38, *ante*), the tune being formed by a series of pins set in a tablet. This tablet is drawn through a frame, in which project wedge-shaped ends of levers; and these are depressed by the pins as they pass over them. For the piano-forte, the levers are connected with the hammers; but, for the organ or harmonium, they act on a series of rods, pressing immediately upon the keys of the clavier. This apparatus possesses therefore a great advantage over the barrel system, inasmuch as it is entirely separate and distinct from the instrument, and may be applied, for a few guineas, to any existing finger organ or harmonium, without in the least interfering with its construction. It may be put in action in a few minutes, or removed in an equally short time, leaving the clavier perfectly free for playing upon with the fingers. There is also a novel contrivance in this apparatus peculiarly useful for accompanying chants or psalm tunes in churches. In the ordinary arrangement of the machine for playing pieces in strict time, the tablet is drawn through the frame by a rack and pinion,—the latter being turned by a winch at a uniform rate; but it almost always happens, in the case of psalmody and chanting, particularly the latter, that the time must be relaxed, occasionally, to suit the singers. To enable the player to do this, an apparatus is added, by which tablets, containing music of this description, are drawn through, not by a rotatory but by a reciprocating motion, so that each thrust of a lever, backwards or forwards, brings on one note of the tune. It is obvious that, by this arrangement, the duration of each note may be prolonged or shortened at the pleasure of the player, and therefore may be accommodated to the singing with perfect ease.

A small kind of harmonium is made, which can be placed immediately in front of the key-board of a piano-forte, and played in conjunction with it. We have already noticed an arrangement of this description at page 31, *ante*.

A still smaller instrument, of the same kind, is exhibited by Messrs. Wheatstone, called the "folding harmonium." It has a compass of 5 octaves, and when expanded for use is 41 inches long, 10 inches deep, and 25 inches high; but by an ingenious arrangement it is made to fold in the middle of

the clavier, and also underneath, by which its dimensions are reduced to 21 inches long, and $10\frac{1}{2}$ inches high, a size but little exceeding that of an ordinary writing desk. Another folding harmonium, called an *orgue de voyage,* is exhibited in the French department by M. Muller, but this merely folds in height, retaining the full length of the clavier.

Mr. J. Storer exhibits a free-reed instrument, which he calls the "œolomusicon," the peculiarity of which is, that the vibrating tongue and its plate are formed from one and the same piece of metal.

Mr. R. Snell exhibits a "bichromatic seraphine," intended to give perfect harmony in any key. The clavier is exactly the same as usual, but the instrument contains a double chromatic scale, *i.e.*, 24 notes in each octave; from which, by means of pedals, the proper sounds are selected and adapted to the key-board, rendering all the common chords perfect in each particular key without any trouble to the player. There are 12 pedals, one corresponding to every semitone; and, in order to play the instrument, nothing more is required than to put down the pedal corresponding with the key note before commencing any piece. The principle is stated to be also applicable to the organ.

The free-reed, with a pipe attached, is now frequently used in organs by foreign builders; it gives a smoother kind of tone than the beating-reed. The addition of a pipe of proper proportions causes it to speak more promptly, and improves the tone. The French and German organs in the Exhibition contain stops on this plan. It has not yet been adopted by English manufacturers.

THE HARP.

The harp, if it has few claims to importance on musical grounds, has, at least, the distinction of a high antiquity. Wherever antiquarian research has penetrated, this instrument appears as one of the most prominent musical contrivances of ancient times. And this is but natural, if we consider its extreme simplicity. It is but a set of strings, stretched on a frame; and, as soon as the discovery was made, that cords, subject to tension, would produce agreeable sounds, the invention of the harp, or something equivalent to it, must have followed as a matter of course. Warlike savages have been known to make a sort of wild music by the twanging of their bow-strings; and the ancient poets fancifully ascribe the instrument of Apollo to the hint given him by the sound of his sister Diana's bow.*

Ancient Harps.

The records of Holy Writ, the antiquities of Egypt and of Assyria, and the ancient literature of Greece, may be cited in proof of the early date at which the harp existed.

There appear to be two stringed instruments mentioned in the Bible, as in use among the Jews, viz.:—

1. The כִּנּוֹר; this is the earliest instrument mentioned, and its invention is ascribed (Gen. iv., 21.) to Jubal, the seventh in descent from Adam. David used it in expressing his pious feelings, as we find from several Psalms. Josephus, in his Antiquities (book x., ch. 12., sec. 3.), describes it as having ten strings, and as being played upon by a *plectrum;* but this does not agree with 1 Sam. xvi., 23, where David is said to have played on it with his hand.

2. The נֵבֶל, a word also signifying a wine bottle, from which the musical instrument probably took its name. The ancient wine jugs were usually in the form of a sugar loaf, which this kind of harp resembled. Jerome describes it as being of a triangular shape, like the Greek Δ inverted. Jo-

* The Greek word ψαλμος, which now bears so elevated a musical signification, literally means the sound of a bow-string.

sephus mentions this instrument as being played upon by the hand, and having twelve strings; but in Ps. xxxiii., 2, the same word is used in the expression, "an instrument of ten strings."

It would seem that these instruments were more portable than our harps, as they were played in a procession; but that they embodied the same essential principles there can be no doubt whatever.

The Egyptians, who, there is reason to believe, possessed musical instruments superior to those of the nations of antiquity that followed them, used a kind of harp which must have been but little inferior, either in elegance of form, skill in construction, or musical powers (if we except the pedals) to the harp of the present day. In an ancient sepulchre, among the ruins of Thebes, Bruce, the traveller, discovered a drawing of the harp, which he considered must have been executed between 1600 and 1500 years before the christian era. The harp was represented as about 6 feet high, supporting itself in equilibrio on its foot or base, and needing only the player's guidance to keep it steady. It had thirteen strings, and a sounding-board, as nearly as possible corresponding in shape and position with that of modern date. It appears also to have been finished with much taste and elegance. The letter of Bruce to Dr. Burney, containing an account of this instrument, concludes with the following striking reflection: "This harp overturns all the accounts of the earliest state of ancient music and instruments in Egypt; and it is altogether, in its form, ornaments, and compass, an incontestible proof—stronger than a thousand Greek quotations—that geometry, drawing, mechanics, and music, were at the greatest perfection when the harp was made; and that what we think, in Egypt, was the invention of arts, was only the beginning of the era of their restoration." This account of Bruce was at first received with some suspicion; but later travellers have confirmed his statements.*

The sculptures discovered by Dr. Layard, in the ruins of Nineveh, also contain representations of a musical instrument, which cannot be better described than as a portable harp. It occurs in three different places in the series of slabs now deposited in the *Nimrúd* room at the British Museum. Two of these represent processions, in which the king, returning from hunting, is met by five figures,—the two last being musicians, standing side by side, and playing upon the in-

* The famous Egyptian pillar, brought to Rome by Augustus, and now known by the name of *la guglia rotta*, bespeaks a still higher degree of improvement in stringed instruments, namely, the addition of the *finger-board*.

strument referred to. In the third slab, representing the Assyrian camp, a group of warriors, carrying the heads of the slain, are rejoicing in company with two musicians, also with harps in their hands.

The instrument is precisely alike in all the representations. It has a frame, consisting of a long and a short piece, attached together at right angles in the form of an L,—the strings being stretched diagonally from one to the other. The number of strings is, in every case, nine, and the whole instrument would appear to be 2½ or 3 feet long. It is held under the arm of the player, with the long side of the frame horizontal, and the short piece (at the end of which a hand is sculptured) pointing upwards in front. The right hand of the musician is elevated, and holds a small rod or *plectrum,* with which, no doubt, the instrument was played; the left hand is shewn extended flat over the strings, but for what purpose is difficult to decide; it may be either for damping the vibration, or for stopping the length of the string, or for playing with the hand alone, alternately with the plectrum. The instruments are partly hidden, and from this cause, as well as from the general imperfection of the drawing, the representations are somewhat obscure.

In the literature of ancient Greece, we find mention of three instruments of the harp kind, but probably differing little from each other. The φορμιγξ (*phorminx*) was the oldest stringed instrument of the Greek bards, and is often mentioned by Homer, especially as the instrument of Apollo (Iliad I., 603, and 24, 63). It was frequently adorned with gold, ivory, precious stones, and carved work. The κιθάρα (*cithara,* whence our word guitar) was a kind of lyre, or harp of a triangular shape, with seven strings originally, but afterwards increased to nine or eleven. This is also often mentioned by Homer, but with a trifling variation (κιθάρις) in the orthography. The λυρα (lyra) is said to have been invented by Hermes, but is not mentioned in Homer. It had seven strings, like the *cithara;* but the body of the instrument was larger, and the tone more full and rich; and on this account it was considered the most manly of all stringed instruments. The *cithara* was held on the knee; but the *lyra* was too large for this position, and is therefore supposed to have stood on the ground, like the harps of modern times.

The harp has, however, an antiquity in our own islands,—the Welsh and Irish bards being celebrated from time immemorial for their performances on this instrument. Before the invasion of Julius Cæsar the Britons had music; and the

bards, like the Levites among the Hebrews, were the sacred musicians. We have the authority of the venerable Bede for the practice of social and domestic singing to the harp in the Saxon language, in this island, at the beginning of the eighth century.

The Celtic harpers are mentioned by Diodorus Siculus, who says they played on instruments like lyres; *οργάνων ταῖς λυραις ὁμοίων*. Also Fortunatus, lib. vii., carm. 8.

> "Romanusque lyra, plaudat tibi barbarus harpa,
> Græcus Achilliacha, crotta Britanna canat."

Crotta is *crwth* Latinized,—this being an original British or Welsh instrument, somewhat distinguished from the *telyn*, or harp peculiar to the bards. All our historians relate the romantic tale of Alfred reconnoitring the Danish camp in the disguise of a harper; and there is good reason to believe that the harp was a favorite instrument among our Saxon ancestors. An ancient Irish harp, which had twenty-eight strings, and was thirty-two inches high, is reported to have belonged to a certain king, Brian Boromn, who was killed in battle in the year 1014. It was presented to the Pope by his son, was afterwards in the hands of King Henry VIII., and is now in the library of Trinity College, Dublin. The modern Irish harp is strung with strings of brass wire, nine in number, and is calculated only for a melody of an imperfect description. Whether the Welsh had their harp from Ireland, or the Irish theirs from Wales, is still a dispute between the champions of St. David and St. Patrick.

Description of the Harp.

The harp in its primitive form consisted simply of a set of strings, extended on a frame,—one end of each string being fixed, and the other wrapped round a pin, for the purpose of tightening to any required tension. The frame was formed of a triangular shape, so as to admit strings sounding different notes, according to their length. It seems, however, to have been very early discovered, that the mere twang of a string was insufficient to produce any considerable tone without the aid of some resonant body; and hence arose the addition of the *sound-board*, a thin elastic substance, so placed as to vibrate under the impulse given to the string, and thus to prolong and strengthen its tone. The sounding contrivance seems to be very ancient; and indeed one account of the origin of the lyre is, that Mercury formed it by fastening strings to the shell of a tortoise, whence it was called *testudo*,

"the sounding shell." In the lyre tribe of instruments, of which the guitar and the violin are modern representatives, this idea has been followed out by the adaptation of sounding-boards underneath and parallel to the strings;—a principle also adopted in the piano-forte, and the most favorable one for effect, inasmuch as the reverberating body may be given a considerable extent of surface, and placed in the best acoustical position. In the harp, however, the adaptation of this arrangement has been impracticable, from the necessity of using the hands on both sides of the series of strings; and hence the sounding-board has been limited to a very small surface, formed by extending and flattening that side of the triangular frame to which the lower ends of the strings are attached. Harps with this addition appear among the oldest representations of the instrument that have been found.

The arrangement and tuning of the strings in the ancient harps, no doubt corresponded to the systems of melody predominant in those times;—since the introduction of our present musical scale, they have invariably been arranged diatonically,—*i. e.*, with the diatonic scale of seven notes repeated in different octaves. Now it is evident, at first sight, that such an arrangement has the disadvantage of being limited to the capability of playing in one key only,—namely, the key it is tuned to; there being no chromatic notes to provide for either what are called accidentals, or for modulation into any other scale. The efforts to remedy this defect have given rise to the only improvements and alterations of any importance which have been made in the powers and construction of the harp since the time of the ancients. Probably the first expedient resorted to was to increase the number of strings in the octave, by adding some of the most useful chromatic notes; but the increased difficulty of playing, arising from the confusion of notes, and from the disturbance of the natural progression of the scale, has prevented any contrivance of this kind from coming into use.

In the fourteenth century an arrangement was introduced in Wales which remained until it was superseded by the better method of pedals: this was the *triple-stringed harp*. It has, as its name implies, three rows of strings, arranged in three parallel planes a slight distance apart. The two outside rows are tuned in unison with each other, and diatonically; while the inner or middle row supply the chromatic semitones. When, therefore, these notes are required, the performer inserts his fingers between the strings of the outer row, and touches those of the inner one, which are placed *en échelon*

for that purpose.* A good specimen of the triple-stringed harp, made by Mr. Bassett Jones, of Cardiff, was in the Exhibition.

The contrivance of additional strings was, however, in its best state, an unmanageable expedient; a much more practicable one was that of altering, temporarily, the pitch of the diatonic notes, in order to form the chromatic semitones as they were wanted. This plan, the foundation of the present system of harp pedals, must have originated in the analogous *stopping* of the strings of the lute, which is proved to have been practised at a period of very remote date.† We learn that about 1660, a plan of altering, temporarily, the pitch of the strings of the harp, was adopted in the Tyrol; it was by means of a catch or lever, moved with the hand; but whether this acted by "stopping" the string, or by altering the tension, is not clear. However this may be, the contrivance was an imperfect one, as it required the hand to be removed from the string. The ingenious invention of pedals, which obviated this difficulty, is ascribed by some to Hochbrucker, a harp-maker at Donauwerth, in 1720; by others to a M. Simon, of Brussels, in 1757; and harps constructed on this plan were heard by Dr. Burney, in 1772, at Brussels and Paris. The mechanism was, however, very imperfect, and the invention did not attain any degree of excellence till 1794, when Sebastian Erard took out a patent for his improvements upon it. The harp, as a generally useful instrument for modern music, may be said to date its existence from this time.

The pedal harp of Erard consisted of a single row of strings, about five octaves in compass, and arranged diatonically. From the foot or stand of the instrument projected seven pedals, connected by machinery (concealed in the upright pillar and curved head) with certain small studs or catches, serving, when the pedals were depressed, to stop the strings at a point near their upper end, and thereby to sharpen them one semitone. The seven pedals corresponded to the seven notes of the scale, and the movement of each was repeated for the several octaves of strings; so that, for example, when the pedal corresponding to C was put down, it pressed a stud or catch upon every C string throughout the instrument, by which the whole were

* The triple-stringed harp is described by Mersennas in his "Harmonie Universelle," 1636.

† Independently of the Egyptian example of the finger-board already alluded to, there is also a very ancient indigenous Indian instrument called the *wina*, the strings of which are stopped by the fingers. The lute of the Arabians was brought by the Moors into Spain, and became the model of all the varieties which this instrument has assumed in Europe.

raised one semitone,—*i. e.*, every C became C sharp; and when it was let go again, the strings were released from the catches, and returned to their original pitch. There was a notch in the pedal-frame, in which the pedal could be engaged if necessary, and thus the pitch could be permanently as well as temporarily altered. In order, by this contrivance, to render the harp as generally useful as possible, as regards its capability of modulation, it was tuned, in its normal or free state, in the diatonic scale of E flat. By putting down the A pedal therefore, the note A flat could be converted into A natural, and the harp thus thrown into the key of B flat. Similarly the addition to this of the E pedal would put it in F; and the whole of the pedals being brought into action together would give the key of E natural; so that the instrument could be played on in any scale between E flat and E natural, giving a range of eight major keys.

Beyond this range, however, it could not go; and, as musical composition began to take a wider field, the imperfections of the instrument were seriously felt, until the introduction of the "double action," by Erard, in 1808. The principle was, while retaining seven pedals as before, to give to each pedal a double movement, by which it could be made to sharpen the string either one or *two* semitones, at pleasure. This was accomplished by making two notches for the pedal to catch in, one below the other, and connecting its machinery with two corresponding stops on the string. Supposing therefore a certain open string to be tuned to the note C flat, the putting down of the C pedal to its first notch would sharpen the string one semitone, viz., to C natural, and, by fixing it in the second notch, it would give C sharp, one semitone higher still. This is the form in which the harp is now used. The open strings are tuned in the diatonic scale of C flat; and by means of the pedals the instrument can be put in any key between this and C sharp, giving as great a capability of modulation as upon the pianoforte. For example, if the key of A flat is required, the strings C, F, and G, are sharpened one semitone, and the others left as they were. If B natural is wanted, the notes B and E are sharpened one semitone, and C, D, F, G, and A, two semitones.

The mechanical contrivance now used for stopping the strings is an improvement upon that adopted for the single-action harp: it was formerly a simple stud or catch, which pressed the string down on a fixed bridge below it,—acting, in fact, just like the finger upon the fret of a guitar; the modern contrivance consists of two pins, fixed on a revolving circular

disc. When the pedal is loose, the pins stand in a horizontal line, and the string passes between them without touching; but, when the pedal is put down, the disc is made to revolve through a little more than a quarter of a circle; so that the pins attack the string, one on each side, and pinch it firmly between them,—the lower one then acting as a stop, and limiting the vibrating length of the chord. Of course each string is provided with two of these stopping discs,—the upper one coming into action at the upper notch of the pedal, the lower one further down.

The harp has now a compass about the same as the piano-forte, viz., 6 or 6½ octaves. In order to distinguish the notes, every C string throughout the instrument is colored red, and every F blue: the other strings are left their natural color. The material of the strings is fine catgut, carefully prepared for the purpose,—the best quality being imported from Italy. The few lowest notes are of silk, lapped with fine silver wire.

Several harps, by Messrs. Erard and other makers, of the most modern construction, have been contributed to the Exhibition; but they possess no peculiarities calling for special notice.

Notwithstanding, however, all the improvement the harp has received, it still is, and probably will remain, an imperfect instrument. From the necessarily small size of the sound-board, it is deficient in resonance and *sostenuto*,—the lower notes being heavy, dead, and scarcely appreciable; while the sharp snappish sounds of the small and excessively-tightened strings, at the other extremity, can hardly be rendered agreeable even by the most skilful players. The difficulties too of execution on the harp are still very formidable, and, when chromatic passages or extensive modulations are used, become almost insuperable without more labor and practice than the effect to be obtained deserves. But the greatest evil of the harp, is the imperfect and fickle nature of the material of which its strings are composed, causing their frequent breakage, and rendering the instrument incapable of standing in tune. It is well known that a harp must be tuned afresh every time it is played on; and it is fortunate if, during a performance, the necessity does not arise either for replacing a broken string, or re-adjusting one that has gone out of tune.

With these disadvantages it might well be supposed that the harp would, at the present day, fall into disuse; but it still possesses its admirers, who, we may suppose, are attracted to it rather from its historical associations than its musical powers.

ORCHESTRAL INSTRUMENTS.

The Exhibition contains many examples of the violin tribe, viz., violins, violas, violoncellos, and double basses, of both English and foreign manufacture; but, as these instruments appear to have arrived at their highest grade of perfection under the hands of the celebrated Cremonese artists of the seventeenth century, and as modern makers have aimed at little beyond copying the works they left behind them, the Exhibition has afforded us no opportunity for enlarging on this class of instruments. We notice, however, two novelties. The first is a monster double bass by M. Vuillaume, of Paris, about eleven or twelve feet high, the strings of which are stopped by machinery connected with a series of levers or handles, placed immediately above the shoulder of the instrument, and within reach of the left hand of the player. It has three strings, on the Italian plan; but the depth of its pitch, or what have been the results of its trial in the orchestra, we could not learn. The other violin novelty we only mention to give it unqualified condemnation; it is an American attempt to make the violin playable with a clavier,—an attempt which, if successful, could only have the effect of depriving this noble instrument of every one of its best and most characteristic qualities, and reducing it to a nondescript noise-making apparatus of the lowest grade.

Orchestral wind instruments are well represented at the Exhibition; there are bassoons, clarionets, oboes, &c., by many makers; and flutes of various materials, such as wood, glass, and metal, with all sorts of improvements in the way of keys. The brass instruments are very numerous, and well exemplify the rapid improvements, and the many important novelties, which have appeared in this department of musical manufacture during the last few years. We may particularize one large case of military instruments by Messrs. Adolphe Sax and Co., of Paris. Among its contents are a new kind of instrument, called the Saxophone, speaking with a mouth-reed, like the clarionet and bassoon, but having a metal body, and a somewhat different form: it is made in

three sizes, for soprano, alto, and bass. There is also a kind of monster ophicleide, called the *Sax-horn bourdon,* about ten feet high, and with forty-eight feet development of tube; also *Saxo trombas,* and various other instruments "système Sax." We must also allude to the "Sommerophone," a kind of ophicleide of much power and capability, which has been played in the Exhibition by M. Sommer, accompanied on some of the organs. The introduction of the cornet-à-piston, some years ago, seems to have given, all at once, a new insight into the capabilities of instruments of this class; and we doubt not the time will soon come when, under judicious management, the late improvements will find a legitimate place in orchestral compositions. The defects of the old trumpet and horn have now become scarcely endurable, and their retention will soon be unjustifiable, when so much superior substitutes for them may be found.

In concluding our review, we may remark, that fewer novelties are exhibited in the department of Musical Instruments than might fairly have been expected; but the contributions are, generally speaking, excellent examples of the manufacture in its highest state of perfection; it cannot therefore be doubted that the Exhibition, in encouraging the production of instruments of the first class, and in affording an unexampled opportunity for their display, will do good service to musical as well as to industrial art.

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